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MOUND PIPES.

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IT is impossible to determine what was the earliest form of the tobacco-pipe. The oldest examples of which we possess any knowledge, have been exhumed from some of the mounds of the Mississippi valley. These are usually made of stone of great hardness, but we have no reason to believe that this material was always employed in their manufacture. It is not to be supposed that the symmetrical and highly-finished specimens which the mounds have produced were the results of the first savage conception of the narcotic utensil. Indeed, it is more than probable that the most ancient pipes were rudely fashioned from wood or other perishable substances, all traces of which have long since disappeared.

The earliest stone pipes from the mounds were "always carved from a single piece, and consist of a flat curved base, of variable length and width, with the bowl rising from the center of the convex side. From one of the ends, and communicating with the hollow of the bowl, is drilled a small hole, which answers the purpose of a tube; the corresponding opposite division being left for the manifest purpose of holding the implement to the mouth."[1] It would be difficult to conceive of any other form so admirably adapted to the purpose for which it was designed. Such pipes are not only models of compactness, but are, in many instances, highly ornamental, and in all probability totemic. In the majority of these "platform" pipes, the stem perforation, which is always straight, is so minute as to preclude the possibility of the insertion of an additional stem. The

[1] Ancient Monuments of the Mississippi valley, p. 228.

implement was complete in one piece, so that all parts were equally durable. The facts that such pipes had expended upon them all of the ingenuity and skill at the command of the sculptor, and that they were usually placed in association with human remains, go far to prove that they were invested, to a considerable degree, with a religious, or at least a mortuary, significance. "The remarkable characteristics of their elaborately sculptured pipes, and their obvious connection with services accompanying some of the rites of sacrifice or cremation, tend," as Dr. Wilson observes, "to suggest very different associations with the pipe of those ancient centuries from such as now pertain to its familiar descendant. Embodying, as these highly-finished implements did, the result of so much labor, as well as of artistic skill, there are not wanting highly suggestive reasons for the opinion, that the elaborate employment of the imitative arts on the pipe-heads found deposited in the mounds, may indicate their having played an important part in the religious solemnities of the ancient race."

The typical mound pipe is of the "*monitor*" form, as it may be termed, possessing a short, cylindrical, urn, or spool-shaped bowl, rising from the center of a flat and slightly curved base. Fig. 1 is an illustration of an example from a mound in Ross county, Ohio, which is now deposited in the National Museum at Washington. Pipes of this form average three or four inches in length, but an extraordinary specimen formerly in the collection of Mr. O. A. Jenison, of Lansing, Mich., measures six and five-eighths inches.

The most important and interesting discovery of mound pipes was made by Messrs. Squier and Davis, during their explorations in the valley of the Mississippi, about a third of a century ago. From a small sacrificial tumulus in the vicinity of "Mound City," Ohio, they obtained nearly two hundred stone pipes. Many of these, according to the report of the discoverers, "were much broken up, some of them calcined by the heat, which had been sufficiently strong to melt copper, masses of which were found fused together in the center of the basin. A large number have nevertheless been restored, at the expense of much labor and no small amount of patience. They are mostly composed of a red porphyritic stone, somewhat resembling the pipe stone of the *Coteau des Prairies* excepting that it is of great hardness and interspersed with small variously colored granules. * * * *

The bowls of most of the pipes are carved in miniature figures of animals, birds, reptiles, etc. All of them are executed with strict fidelity to nature, and with exquisite skill."[1] With the exception of this large deposit of these objects, comparatively few of them have been brought to light; yet a number of them are scattered through public and private museums in the United States and Europe, some of which will be described hereafter. It is a matter for sincere regret that the greater portion of the original collection of Dr. E. H. Davis was sold to the Blackmore Museum at Salisbury, England, some years ago. In the Museum of Natural History in New York City, however, thirteen of the original specimens, formerly owned by Mr. E. G. Squier, may yet be seen, including the remarkable example represented in Fig. 142 on page 244 of *Ancient Monuments*. In the magnificent collection of pipes recently owned by Mr. William Bragge, F.S.A., of Birmingham, England, are three broken bird-shaped pipes from "Mound City," Ohio. A set of casts of the entire Squier and Davis collection is preserved in the National Museum at Washington. Amongst the pipes of the original series were a number supposed to represent animals not indigenous to the United States. Seven representations of the lamantin, or sea-cow, were found in the mounds, three of which were nearly perfect. "The sculptures of the manatus," remark the explorers, "are too exact to have been the production of those who were not well acquainted with the animal and its habits."[2] Though frequenting the mouths of tropical rivers, the "big beaver," as the Florida Indians called this curious animal, has been found within the boundaries of the United States. Bartram states that it occurs in Florida, in a spring a few miles below Tallahassee.[3] The manati are comprised in three or four species, two of which are found in the Gulf of Mexico. The more northern species *(Manatus latirostris)* is found in 25° N. lat., and Harlan states that during the first quarter of the present century it was so abundant near the capes of Eastern Florida that one Indian sometimes captured ten or twelve specimens with a harpoon in a single season.[4] This species, which sometimes attains to a length of fifteen or twenty feet, bears a striking resemblance to the smaller *M. senegalensis* of

[1] Ancient Monuments, p. 152.
[2] Ibid, p. 254.
[3] Travels in North America, Dublin, 1793, p. 229.
[4] Fauna Americana, 1825, p. 277.

Western Africa. In both of these species the caudal fin is rounded, and the fingers on the swimming paws of the former species are provided with rudimentary nails. The Indians were extravagantly fond of the flesh of the manatee, the tail being considered the most savory portion. The following quaint description of the species inhabiting the Indian ocean is interesting as given by an early writer: "It is good Meat, because using the Shoar it hath a flesh taste, resembling Veal, which also it shews like; the Face is like a shrivelled Buffalo or Cow, the Eyes are small and round, and has hard Gums instead of Teeth; the Intrals also are like a Cow's: there is a Stone generated in the Head, which is very valuable, being a soveraign remedy (as some report) against Cholick, Stone-Cholick, and Dysentery, being beat small, infused in Wine, and drunk fasting: the Body of this Fish is three Yards long and one broad, thick-skinned, and without Scales, narrow towards the Tail, which is very nervous, slow in swimming, because it wants Fins, in lieu of which it has two Paps, which it can use either to suckle its young withal, or creep ashoar, where it grazes, and where it delights to lie and sleep; for it can't keep half an Hour under Water. It is very teachable and apt to be made tame, being famed like the Lizzard for their love to Man, whose Face they delight to look upon, and in weakness have refreshed them."[1]

One of the sculptures referred to above, is represented with a flat, truncated tail, which may possibly have been intended for the South American species *(M. australis)*, though it is not probable that the ancient mound-builder was familiar with exotic models of this animal. I am inclined to believe that this feature was the result of an inaccuracy in detail on the part of the sculptor, especially as all of the other representations exhibit the rounded tail of the Floridian species.

Another carving of ruder execution has, with some hesitation, been described as the toucan, a bird not found in the northern part of the western continent. Since the Indians of Guiana and Brazil, according to the statements of travelers, formerly domesticated this bird, the fact that the sculpture in question is represented in the act of taking food from a human hand, "would favor the conclusion," according to the discoverers, that it was

[1] Sir Thomas Herbert's Travels in 1626. From Navigantium atque Itineratium Bibliotheca, by John Harris, F.R.S. London, 1705, Vol. 1, p. 408.

intended to represent the toucan. The shape and proportions of the beak and the number and position of the toes, however, are sufficient evidence that the bird which formed the model of the artist, did not belong to the zygodactylous order. The pipe shows three toes in front and the bill is short and stout. The builders of the mounds probably possessed their aviaries which, like those of the ancient Mexicans, doubtless supplied a number of species which were capable of domestication.

FIG. 1.—Monitor Pipe.

FIG. 2.—Otter Pipe.

Several of the images, however, are undoubtedly portraitures of familiar animals. "Not only are the features of the various animals represented faithfully, but their peculiarities and habits are in some degree exhibited."[1] In one pipe we recognize the otter with a fish in his mouth (Fig. 2). The tufted heron is seen in the position of devouring a fish (Fig. 3). "Nothing can surpass the truthfulness and delicacy of the sculpture. The minutest feathers are shown; the articulations of the legs of the bird, as

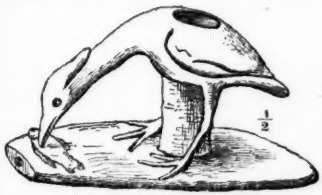

FIG. 3.—Heron Pipe.

FIG. 4.—Beaver Pipe.

also the gills, fins and scales of the fish, are represented."[2] The hawk is shown in the act of tearing a smaller bird.[3] The beaver also figures in the collection (Fig. 4), as also do the bear, panther, wolf, wild-cat, elk, opossum and squirrel; the buzzard, crow, eagle, falcon, owl, raven, duck, grouse, parroquet and swallow; the serpent (rattlesnake), turtle, frog, toad and a number of other animals which have been readily recognized. The sockets of the

[1] Ancient Monuments, p. 152.

[2] Ibid, p. 259.

[3] For illustration of this sculpture, see *Harper's Monthly Magazine*, June, 1855.

eyes in the majority of the bird pipes were set with pearls from the margaritiferous Unionidæ.

The most valuable specimens of the series, however, are those in the form of the human head, probably "faithfully representing the prominent physical features of the ancient people by whom they were made."[1] Fig. 5 illustrates the most interesting example in this valuable collection.[2]

Next in importance to the discoveries of Messrs. Squier and Davis, is the collection of mound pipes deposited in the Davenport Academy of Natural Sciences, and for the greater part taken from mounds by members of that learned body. The series number forty-three specimens of the platform type, consisting of twenty-two with plain or zoned bowls of the "monitor" pattern; one human head; seven birds, and thirteen other animal forms, of which Mr. W. H. Pratt has kindly sent me photographs.

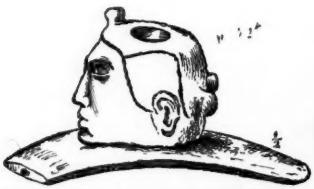

FIG. 5.—Pipe from Squier and Davis collection.

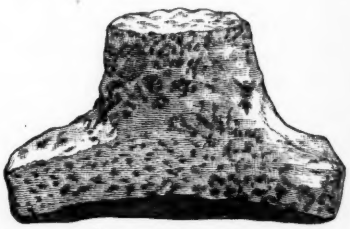

FIG. 6.—Unfinished Pipe.

An interesting and instructive specimen, in the form of an unfinished pipe, was taken from a mound at Toolsborough, Louisa county, Iowa, which serves to show, to a certain extent, the manner of fashioning such objects. The material is a coarse, soft, cream-colored stone, which has been roughly hewn into the desired shape (Fig. 6). The inference to be drawn from the presence of an incomplete pipe in one of the mounds, is either that it was discarded on account of the unsuitableness of the material, or that it was placed in the tumulus as a substitute for a perfectly finished specimen which could not be procured at the time when the body it was intended to accompany was deposited. An

[1] Ancient Monuments, p. 153.

[2] The illustration of this pipe and those which precede, have been furnished through the courtesy of Professor S. F. Baird, secretary of the Smithsonian Institution, from Dr. Charles Rau's work on the Archæological Collection of the United States National Museum.

incomplete object, somewhat resembling this, in which the cavity of the bowl is merely indicated, is figured in Mr. E. G. Squier's "Aboriginal Monuments of the State of New York."[1] It is made of steatite and was found near Mount Morris, Livingston county. The original of Fig. 7 is a bird-shaped pipe carved from

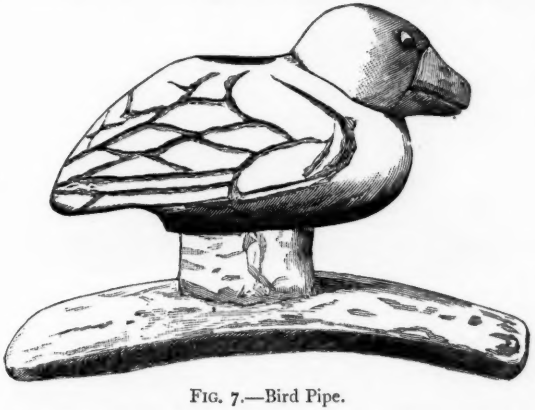

FIG. 7.—Bird Pipe.

a bluish-gray pipe stone. It was found associated with portions of several human skeletons and a four-sided, bent copper "awl," about six inches in length, in a mound of the same group as the last one figured. This was possibly intended to represent a spe-

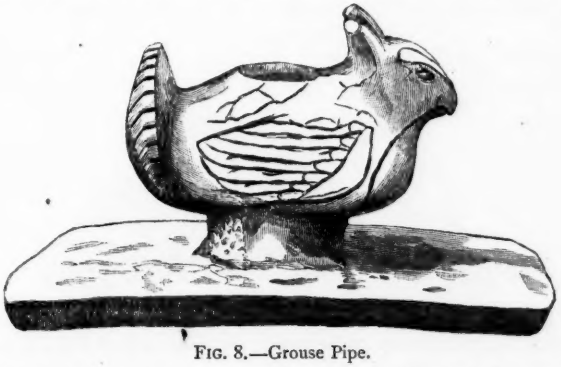

FIG. 8.—Grouse Pipe.

cies of wild duck, the eyes of which were globules of pure native copper. From another mound of the same group was taken a second bird pipe of the same material, which is shown in Fig. 8,

[1] Smith. Cont. to Knowl. Vol. II, p. 76 (Fig. 12).

and is believed to portray the male of the pinnated grouse. In the same mound were found portions of several human skeletons, about two hundred shell beads, five copper axes, one of them "a very smoothly wrought specimen, showing very distinct traces of the cloth in which it had been wrapped, and some portions of which were still adhering to the copper,"[1] and another bird-shaped

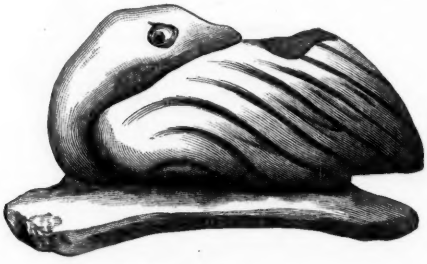

FIG. 9.—Goose (?) Pipe.

pipe of *red pipe stone*, furnished with eyes of pearl. The specimen shown in Fig. 9 may have been meant for the wild goose, or possibly the loon. It is formed of sandstone, and was found in Louisa county, Iowa.

About one mile below Davenport, on the right bank of the Mississippi, the original of Fig. 10, fashioned from a light-gray pipe stone, was discovered in a mound at a depth of six feet,

FIG. 10.—Ground Hog Pipe.

associated with five very old copper, cloth-wrapped axes and two pieces of galena. Above these objects, one and a half feet from the top of the mound, were found two adult skeletons, evidently belonging to an intrusive burial, as they were accompanied by

[1] Vide Proceedings of the Davenport Academy, Vol. I, p. 108.

European relics, such as glass beads, etc. It is difficult to determine what animal was intended, the wolf, ground-hog and prairie-

FIG. 11.—Howling Wolf (?) Pipe.

dog having been variously suggested. The "howling wolf" (?) pipe (Fig. 11) is from a sand hill in Rock Island county, Illinois.

FIG. 12.—Lizard Pipe.

The sculptured lizard (Fig. 12) and the turtle (Fig. 13) are from mounds in Mercer county, Ill. The last three are made of a

FIG. 13.—Turtle Pipe.

soft, dark slate-colored talc. The serpent pipe (Fig. 14) comes from the same locality, and is formed of a sort of clay slate. In close contiguity, in the same mound, a lump of galena, considerably ground down, was discovered, and the pipe presented the

appearance, when found, of having been lightly coated with a plumbiferous substance. Another example carved in the form of

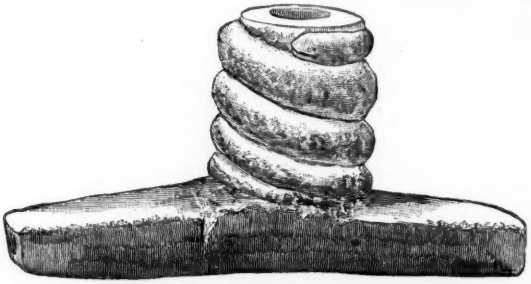

FIG. 14.—Serpent Pipe.

a frog (Fig. 15) from a light-gray pipe stone, was exhumed from a mound in the same group with that which yielded the original of Fig. 10. Associated with the former were two copper axes and five skeletons, of which three faced the east and the others the west. The pipe was found with the latter two.

Having incidentally heard of a pipe in the form of a bear, which was said to have been found in a mound in Muscatine county, Iowa, by a laboring man, the Rev. Mr. J. Gass, a member of the Academy, finally, with some difficulty, discovered the

FIG. 15.—Frog Pipe.

owner and succeeded in purchasing the specimen from him for a paltry sum (see Fig. 16). The peculiarity of this pipe, which is made of a gray trap rock, unpolished, is that, unlike most other platform pipes, it possesses a *straight* base which is not drilled and of which the front projection is lacking, the mouth of the animal forming the mouth-piece for the smoker.

The most remarkable specimens in the Davenport collection, however, are the two elephant pipes recently brought to light, and which have been too hastily pronounced spurious by critics

who have had no opportunity of examining them. The circumstances of the discovery of these two examples are contained in the following extracts from a letter which I have received from

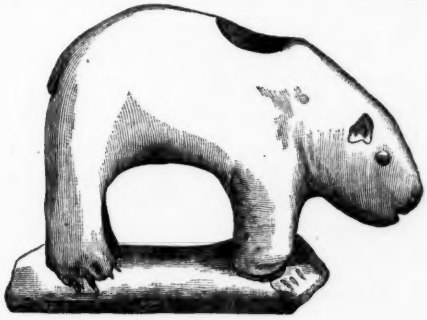

FIG. 16.—Bear Pipe.

Mr. W. H. Pratt, president of the Academy, under date of April 24, 1880: "The first elephant pipe which we obtained (Fig. 17) a little more than a year ago, was found some six years before by an illiterate German farmer named Peter Mare, while planting corn on a farm in the mound region, Louisa county, Iowa. He did not care whether it was elephant or kangaroo; to him it was a curious 'Indian stone,' and nothing more, and he kept it and smoked it.

FIG. 17.—Elephant Pipe, Iowa.

In 1878 he removed to Kansas, and when he left, he gave the pipe to his brother-in-law, a farm laborer, who also smoked it. Mr. Gass happened to hear of it, as he is always inquiring about such things, hunted up the man and borrowed the pipe to take photographs and casts from it. He could not buy it. The man said his brother-in-law gave it to him and it was a curious thing—

he wanted to keep it. We were, however, unfortunate, or fortunate, enough to break it; that spoiled it for him and that was his chance to make some money out of it. He could have claimed any amount, and we would, as in duty bound, have raised it for him, but he was satisfied with three or four dollars. During the first week in April, this month, Rev. Ad. Blumer, another German Lutheran minister, now of Genesee, Illinois, having formerly resided in Louisa county, went down there in company with Mr. Gass to open a few mounds, Mr. Blumer being well acquainted there. They carefully explored ten of them, and found nothing but ashes and decayed bones in any, except one. In that one was a layer of red, hard-burned clay, about five feet across and thirteen inches in thickness at the center, which rested upon a bed of ashes one foot in depth in the middle, the ashes

FIG. 18.—Elephant Pipe, Iowa.

resting upon the natural undisturbed clay. In the ashes, near the bottom of the layer, they found a part of a broken carved stone pipe representing some bird; a very small, beautifully formed copper 'axe,' and this last elephant pipe (Fig. 18). This pipe was first discovered by Mr. Blumer, and by him, at our earnest solicitation, turned over to the Academy."

Mr. J. Duncan Putnam, corresponding secretary of the Academy, writes me that the former pipe "is of a light-colored sandstone, but has been much greased and smoked, so as to appear of a dark color." The material of the latter is the same. There seems to be no flaw in the history of these pipes, which, coming from sources of unquestioned integrity, is evidence that there has been no attempt at deception on the part of the Davenport Academy.

It is not within the province of this paper to discuss the question of the contemporaneousness of man and the mastodon in the western hemisphere. The existence of an artificial mound in Wisconsin, 135 feet in length, *in the form of an elephant*,[1] adds much to the probability of the genuineness of the pipes above described. It is worthy of note, however, that no representations of the male elephant have as yet been found amongst the remains of man in North America. It is, to say the least, a singular fact that the most characteristic features of this pachyderm, the prominent tusks, should have been omitted both in the pipe sculptures and the "big elephant mound," if the ancient Americans were acquainted with the model. The long, slender, curved tusks, however, would be difficult to imitate either in the miniature stone sculptures or the embankments of earth, and might have been purposely ignored. These likenesses of fossil mammals acquire an additional interest, however, when we read the remarkable accounts of the discoveries in the State of Missouri and elsewhere, of deposits of bones of the mastodon in association with flint arrow-heads and fragments of pottery.[2] "Such contiguity of the works of man with those extinct diluvial giants," observes Dr. Wilson, "warns us at least to be on our guard against any supercilious rejection of indications of man's ancient presence in the New World as well as the Old. * * * * Whether or not those huge mammals had been known to man, during his occupation of the American continent, as his living contemporaries, their remains were objects of sufficiently striking magnitude to awaken the curiosity even of the unimpressible Indian; and traditions were common among the aborigines of the forest relative to the existence and destruction of the strange monster, whose bones lie scattered over the continent from Canada to the Gulf of Mexico. * * * * In all that relates to the history of man in the new world, we have ever to reserve ourselves for further truths."[3]

Pipes of the platform type are confined almost exclusively to the section north of the Ohio and Missouri rivers, or to the States of Ohio, Indiana, Illinois and Iowa. A few specimens of the curved-base form have been picked up in other localities, but

[1] Vide Smith. Report, 1872, p. 416. The Big Elephant Mound in Grant county, Wisconsin, by Jared Warner.

[2] See Foster's Prehistoric Races of the U. S., p. 63.

[3] Prehistoric Man, London, 1862, Vol. I, p. 112, et seq.

generally, so far as I can ascertain, on the surface, having in all probability been carried from the mound region by roving bands of Indians of a more recent period. In the National Museum at Washington, are three examples, which were derived respectively from Ohio, Maryland and Illinois. Another was discovered in the valley of the Delaware river in the State of New Jersey. It is of the plain "monitor" form, made of a light-brown or chocolate-colored stone, and is now owned by Mr. Wm. S. Vaux, of Philadelphia, Pa. Hon. R. S. Robertson, of Fort Wayne, Indiana, possesses a pipe of the same form, from a mound in Laport county of the same State, which was found in connection with a copper chisel, two copper needles, four flints, some fragments of pottery and a single skeleton. Two other pipes from Southern Ohio, in the same collection, are cylindrical bowls which have been broken from the curved platforms and put to further use by drilling stem-holes in the sides. One of these shows an opening in the base where it was broken from the stem, the hole being plugged to render it serviceable. The other example has a portion of the platform still attached, which has been smoothed or polished at the point of fracture. In the collection of Dr. C. S. Arthur, of Portland, Ind., are also three curved base pipes with plain bowls, two of which were ploughed up, and the third taken from a mound, in that State.

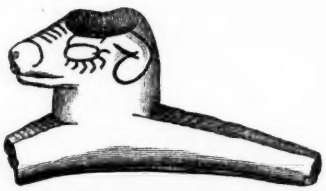

FIG. 19.—"Dog" (?) Pipe.

In a mound at Prairie du Chien, Wisconsin, associated with pieces of mica, an interesting platform pipe was discovered. Hon. Horace Beach, who sends me the original, regards it as decidedly Egyptian in general appearance, and terms it the "dog (?) pipe." It represents the head of some animal, possibly the mountain sheep or goat, and is made of a soft, heavy, dark-brown stone, somewhat resembling Catlinite. The peculiarity of this specimen is that the face looks away from the smoker. As may be seen in the illustration (Fig. 19); the anterior end of the plat-

form, constituting the handle, is wanting. On the upper part of the nose, and on the base, front and back of the neck, hieroglyphical lines are inscribed, which may have possessed some symbolical significance, or perhaps were simply ornamental. In a few examples of pipes of this class, the *platforms* have been carved in imitation of animals. Dr. J. Schneck, of Mount Carmel, Illinois, sends me a sketch of a curious specimen which was found about two feet below the surface of the earth in a mound in Wabash county, Ill. (Fig. 20). It represents a small bird about the size of, and somewhat resembling, the chimney swallow (*Chætura pelasgia* Steph.), which, in those distant days, attached its nest, doubtless, to the cliffs and rocky crags. The material is a soft, yellow slate; the bird is represented on its back with wings crossed beneath, the cylindrical bowl rising from the breast, and the smoking orifice passing through the tail. Dr. Elliott Coues,

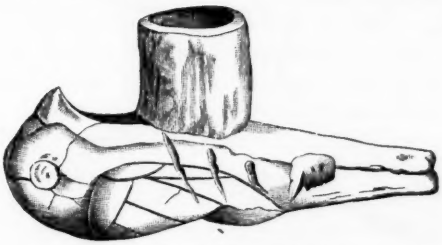

FIG. 20.—Bird Pipe, Illinois.

to whom I sent a sketch of this pipe, writes: "As is so frequently the probable case in such matters, I am inclined to think the sculptor had no particular bird in mind in executing his rude carving. It is not necessary, or indeed permissible, to suppose that particular species were always intended to be represented. Not unfrequently, the likeness of some marked bird is so good as to be unmistakable, but the reverse is oftener the case; and in the present instance I can make no more of the carving than you have done; excepting that if any particular species may have been in the carver's mind, his execution does not suffice for its determination."

Another specimen, in the collection of Mr. N. V. Johnson, of Brookville, Indiana, was found in a marsh a few miles north of that place. The material is a bluish-green stone, very hard and highly polished. Mr. Edgar R. Quick, who sends me a well-

executed colored drawing of this object, writes: "The general form of this beautiful piece of work is that of a crescent with a protuberance on the outside, which forms the bowl of the pipe. The horns of the crescent form respectively the handle and stem or mouthpiece. The handle or front part is beautifully carved in the semblance of a lizard's head." (Fig. 21.)

Although many of the miniature sculptures already described are characterized by a remarkable accuracy of detail, and are faithful representations of well-known animals, the ancient artist was not always true to nature. In some of the carvings, prominent or characteristic features were often exaggerated; the heads of birds and mammals were sometimes disproportionately enlarged; in some instances to such an extent as to suggest to us the idea of caricature. Many of these sculptures were evidently

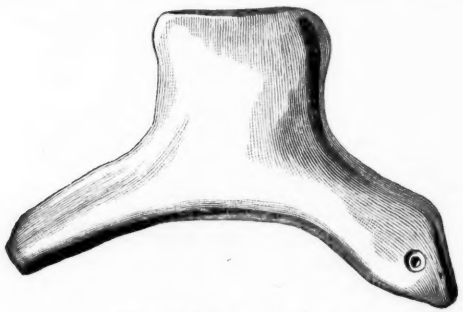

FIG. 21.—Bird Pipe, Indiana.

carved from memory, and errors of execution appear more frequently in the representations of those animals which obviously could not have been perfectly familiar to the sculptor. Indeed, many of these portraitures are scarcely recognizable, and it is often impossible to determine what animal the artist intended to copy. The body of the elephant pipe (Fig. 17) is much elongated and the legs shortened; defects which may be attributed to the inexperience of the workman or his lack of personal knowledge of the model; yet, notwithstanding the fact that certain archæologists have advanced the opinions respectively, that the peccary, the tapir and *the armadillo* were intended to be portrayed, a careful study of the image will confirm us in the belief that the elephant was the animal which the prehistoric artisan had before his mind. It may be asserted with a considerable degree of con-

fidence that no representative of an exclusively exotic fauna figured in the pipe-sculptures of the mound-builders. If we accept the presence of the mammoth or mastodon amongst these carvings, the species which served as models, though now extinct, must be classed with our indigenous fauna. Their knowledge of such animals as the parroquet, the manatus, and possibly the seal and Rocky mountain sheep, does not necessarily indicate any particular migration on the part of that ancient people, but serves to show that their intercourse and commercial relations with other peoples were extensive. As has been previously remarked, however, the artists were apparently well acquainted with some of the birds, mammals and amphibia whose geographical limits were far removed from the upper portion of the Mississippi valley, but which, nevertheless, might have been met with by some of the people in their expeditions. On the other hand, many of the representations were evidently executed from descriptions or rude delineations furnished by those who had seen the originals. The mounds have produced galena from Missouri and the adjacent territory; mica from the spurs of the Alleghany or Rocky mountains; Catlinite from Minnesota; copper from the Lake Superior region; obsidian from Mexico and the Pacific slope of the United States, and marine shells from the Gulf of Mexico, the Atlantic ocean, and also the Dentalium of the Pacific coast.[1] Thus it will be seen that the trade relations of the mound-builders extended over a great extent of territory, in fact, covering the greater portion of the present United States and probably penetrating into British America and Mexico.

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ON THE FLOWERS OF SOLANUM ROSTRATUM AND CASSIA CHAMÆCRISTA.[2]

BY PROFESSOR J. E. TODD.

WITHIN a few years, a plant has been introduced into Southwestern Iowa, which is as unwelcome as it is interesting. It bristles all over on stem, leaves and fruit, with stout, rigid prickles. It is commonly called Texas nettle, as it is supposed to have been brought by the herds of Texas cattle, which in

[1] Vide Ancient Aboriginal Trade in North America, by Dr. Chas. Rau. Smith. Rep., 1872, p. 383.

[2] Read before the Biological Society of Washington, March, 1881.

recent years have been fattened in that region. It is found abundantly in Western Nebraska at present, and although it may have been introduced there in like manner, I presume it is indigenous. It is so put down, I believe, in Coulter's Flora of Colorado.

It has rather conspicuous flowers, of a pure sulphur-yellow color, and of the form represented in the figure. It is a *Solanum*, but very unlike the more familiar forms of the genus. The essential organs are quite unsymmetrical. Four of the stamens are of the normal or usual form, but the fifth, which is on the lower side of the flower, is about twice the length of the others, and has a large, tapering anther, which about the middle is crooked to one side, and its slender apex curved upward as is represented in the figure. This irregularity, doubtless earned for the plant, its cognomen *rostratum*.

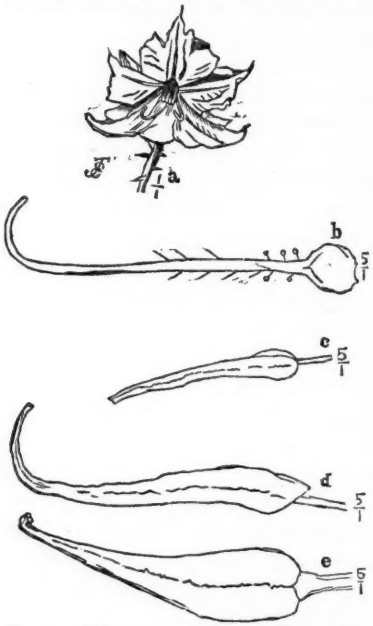

FIG. 1.—*Solanum rostratum*. *a*, flower (natural size); *b*, pistil; *c*, a short stamen; *d*. lateral view of the long stamen, and *e*, view of the same from above.

The anthers open by terminal chinks or pores, as is common to this genus. The long anther shows considerable elasticity, and in its movements throws a puff of pollen from its apex, which, as will be seen, is turned upward and at right angles with its axis.

The pistil, as will be seen from the figure, is turned so as to resemble in general form, size and position, the long anther just described, with this exception, that it turns toward the opposite side of the flower. Moreover, the pistil and longer stamen, in different flowers, exchange directions, so that in some the pistil turns to the right hand, and the stamen to the left, and in others *vice versa*. We will, for convenience, call the flowers in which the pistil turns to the right hand, facing as the flower,

right-handed, and those in which it turns to the left, left-handed. The figure represents a left-handed flower. With a little examination, it is found that there is a very simple law deciding whether any given flower, from its position, should be right-handed or left-handed. In the examination of scores of flowers I found no exception to this law. The flowers are arranged in simple, bractless racemes, which extend in a horizontal position. The flowers, consequently, are arranged on each side of the axis.

The law referred to is this. The pistil, in any flower, turns towards the axis of the raceme. It follows from this, that successive flowers on the same raceme have their pistils turned toward opposite sides. It is also a fact of observation, that the flowers of a cluster on any one branch, and opening about the same time, are either all right-handed or all left-handed. Any plant, however, if it is at all large, exhibits right and left-handed flowers in about equal numbers.

Of five plants observed:

No.	1	had	5	pistils	left-handed,	and	4	right-handed.	
"	2	"	3	"	"	"	1	"	"
"	3	"	1	"	"	"	2	"	"
"	4	"	3	"	"	"	3	"	"
"	5	"	3	"	"	"	4	"	"

The advantage in all this is so obvious that it scarcely needs explanation. It is like most irregularities in flowers, a contrivance for cross-fertilization. After considerable watching, I had noticed no insects visiting the flowers, except a small humble-bee, and this seemed quite attentive. The weight of the bee so springs down the flower, that it is quite difficult, on account of the large flexible corolla, to see just what is done, but repeated observations led me, quite satisfactorily, to this conclusion. The bee seeks the pollen—for the flowers have neither nectar nor odor—and this she uniformly gets from the four shorter stamens; never, so far as I could determine, from the larger one. This she does by seizing each one, near its base, between her mandibles, and with a sort of milking motion crowds the pollen out of the terminal pores; meanwhile, by the movements of her feet, the larger stamen is repeatedly sprung backwards, and as often throws a cloud of pollen on one side of her body; this in a right-handed flower. When she passes to a left-handed flower, which, as was explained above, is very likely not to be on the same plant, the pollen is carried directly to the pistil of that flower, and so on. We have here,

therefore, a novel apparatus for cross-fertilization, quite distinct from those that have been most commonly noticed.

A few days after having noticed the peculiarities of *Solanum rostratum*, my attention was attracted to the asymmetry of the flowers of the more common plant, *Cassia chamæcrista*. Its appearance, when fully open, as in early morning, is shown in the figure. The points that are of special interest to us, are the sickle-shaped pistil, the stamens with long, rigid anthers, opening by terminal pores, and most of them pointed toward the incurved petal, which is always on the opposite side from the pistil, as is shown in the figure. A vertical line let fall across the flower, in its natural position, uniformly falls midway between the two. So we may here speak of the flowers as right-handed or left-handed, as before, according to the position of the pistil. As the inflorescence is less regular than in *S. rostratum*, we have been unable to discover any definite law, as in that case, but different plants have about an equal share of right and left-handed flowers. Observations on some plants that were in rather a dilapidated condition, resulted as follows:

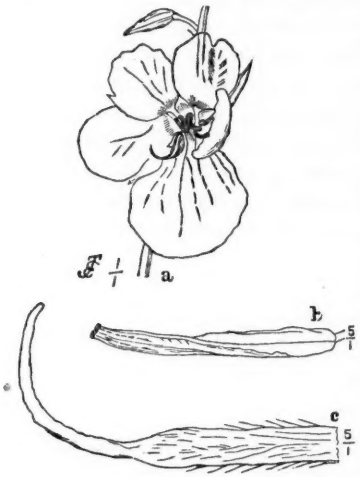

FIG. 2.—*Cassia chamæcrista*, *a*, flower (natural size); *b*, a stamen; *c*, pistil.

Plant No.	1	had	6	right-handed	flowers	and	4	left-handed.			
"	"	2	"	4	"	"	"	"	2	"	"
"	"	3	"	2	"	"	"	"	0	"	"
"	"	4	"	1	"	"	"	"	2	"	"

I found these flowers also visited mainly by a small humble-bee, and judge that they gather pollen in a similar way to that noticed in the *Solanum*. The flowers are nectarless and odorless. The advantage is not so obvious in this arrangement as in the *Solanum*, and I have not had opportunity to study it quite as closely and carefully, but I consider the following explanation the most probable.

In gathering the pollen, some grains are dropped on the incurved petal, and by it made to adhere to parts of the bee, and to such parts in a right-handed flower as will carry it to the stigma of a left-handed flower, and *vice versa.*

So much for the observations upon the plants themselves. Let us trace their more marked peculiarities in related plants, and, if possible, find some hint as to their origin.[1]

In *Solanum rostratum* the particulars in which it differs from the normal form of the genus, are three, viz: (1) The long recurved style; (2) the elongation and enlargement of the lower stamen; and (3) the crooking of them toward opposite sides of the flower. In examining kindred species of this most numerous genus, we find that in our common *S. nigrum* in Southern California, there appears a variety, *S. Dillenii*, which sometimes has its style exerted, and sometimes has it short as in the common *nigrum.* Another, *S. nodiflorum*, in Arizona, which "generally has this feature," passes into *S. Douglassi* which is found at Santa Barbara, Cal. The development of this character seems to attend, and perhaps depends upon, the change of the flowers from a drooping attitude, as in the typical *nigrum*, to a more erect position. The obliquity of the stamens, or their vertical asymmetry, as it might be called, appears in *S. tuberosum* sometimes. I have observed it in the "peach-blow" variety; I have observed it more frequently in *S. Carolinense.* The extreme form, however, which we have found in *S. rostratum*, is confined to the sub-

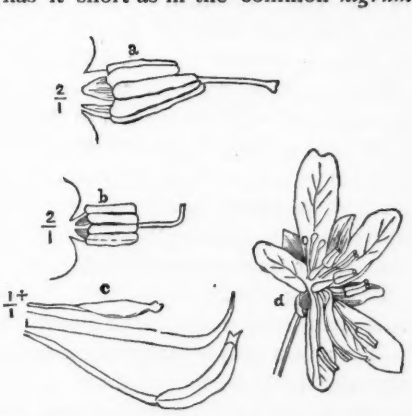

FIG. 3.—*a*, stamens and pistil of *Solanum tuberosum*, unusual form; *b*, do. of *S. nigrum* var. *Dillenii*; *c*, do. of *Cassia occidentalis*; *d*, flower of *C. acutifolia*, after J. Murray. Note.—*b* and *c* were drawn from dry specimens.

[1] This work would necessarily have been very incomplete, had not the library and herbarium of the U. S. Department of Agriculture been freely opened to me by the kindness of Dr. Vasey, to whom I would thus acknowledge my indebtedness.

genera *Androcera* and *Nycterium*. The first has but one long stamen, and *S. rostratum* may be taken as its type. This subgenus is confined to tropical America. *Nycterium* contains species most of which have three long stamens, but some have only one. A table of the species and their distribution is as follows:

tridynamus, obtusilobum and amazonum	} 3	lower	stamens	longer,	Mexico.
Wrightii	3	"	"	"	East Indies.
vespertilio	1	"	"	"	Canaries.
dubium	1	"	"	"	Arabia and North Africa.

Of the lateral asymmetry I cannot speak, for so far as I can learn, it has not been noted. In the case of *Cassia chamæcrista*, the unsymmetrical features are (1) the curved style, (2) the oblique stamens, (3) their abnormal number, and (4) the incurved petal. The first is not peculiar, but is found in nearly all representatives of the order *Leguminosæ*. The second and fourth peculiarities are such as are easily overlooked, and have not, so far as I find, been noted of other species. The third peculiarity becomes significant when we compare this species with a typical one of the genus, such as the one shown in the figure of *C. acutifolia*, which may also represent in general, *Marylandica* and *occidentalis*. Here (Fig. 2) we usually have seven fertile stamens; in that (Fig. 3 *d)* we find the other three of the normal number ten, present, but sterile, as if to indicate that some of the seven are derived from the longer ones of the typical form. One or two of them in *chamæcrista*, instead of following the oblique position of the rest, sometimes stretch out on the side of the pistil.

The advantages of the arrangement in *chamæcrista* for securing cross-fertilization over the more common form of the *Cassiæ*, as in *acutifolia* and *occidentalis*, I think may be seen without further explanation. Moreover, if the insects visit the flowers for pollen, we can readily see the advantage in having the stamens of unequal length, and hence the development by natural selection, of the *Androcera* form of *Solanum*, and the typical *Cassia* from among the *Cæsalpinieæ*

Before leaving the subjects suggested by these flowers, I would indicate several points, and not having time to discuss them more fully, we will leave them in the form of queries.

1. These similar modifications occur in utterly diverse families, having similar geographical distribution, viz: in tropical regions, and perhaps the limitations may be further narrowed to the drier

parts of these regions. May this not indicate that certain physical influences have primarily induced the variations which have been developed into perfect adaptations?

2. May not heliotropism, or the retarding effect of light upon the formation of tissue, partly explain the greater development of the lower stamens, the shortening of the middle, and the abortion of the upper; and may it not also explain the upward curving of the styles and lower stamens in these plants?

3. May not the mechanical action of the insect have some connection with the obliquity of the *C. chamæcrista* flower, and the divergence of the styles and stamens? *C. chamæcrista* is like the typical form turned downward and to one side.

4. In these plants we have found a lack of bilateral symmetry, and we have found it attended with a regular exchange of sides, and that to accomplish a special purpose. Is this commonly so in plants thus irregular, such as the *Cannaceæ* and *Zingiberaceæ?*

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IS LIMULUS AN ARACHNID?

BY A. S. PACKARD, JR.

IN an article by Professor E. R. Lankester in the *Quarterly Journal of Microscopical Science*, for July and October, 1881, entitled "Limulus an Arachnid," the author, distinguished for his histological and embryological papers especially relating to mollusks and Cœlenterates, takes the ground that Limulus, or the horse-shoe or king crab, "is best understood as an aquatic scorpion, and the scorpion and its allies as terrestrial modifications of the king crab," and on p. 507 he makes the following startling announcement: "That the king crab is as closely related to the scorpion as is the spider has for years been an open secret, which has escaped notice by something like fatality." While appreciating the thorough and critical nature of the learned author's work, especially observable in his excellent paper on the structure of Apus, we venture to assert that in regard to the systematic position of Limulus, Professor Lankester has mistaken interesting analogies for affinities, and has on quite insufficient and at times wholly hypothetical grounds rashly overlooked the most solid facts, and safe inductions from such facts, and arrived at very forced and it seems to us strange and quite untenable conclusions.

At the outset, it will be remembered that Limulus differs from

the Tracheates, including the Arachnids, in having no tracheæ, no spiracles, and no Malpighian tubes. It differs from Arachnids in these characters; also in having compound eyes, no functional mandibles or maxillæ, the legs not terminating, as is generally the case in Tracheates, in a pair of minute claws; while its brain does not as in Arachnida supply both eyes and first cephalic appendages. On the other hand, Limulus agrees with Crustacea in being aquatic and breathing by external gills attached to several pairs of biramous feet; in having a simple brain, which as in some groups of typical Crustacea (Branchiopoda, etc.), does not supply any of the appendages, while the structure of the circulatory, digestive and reproductive organs agrees with that of the Crustacea; and, as we have shown in our Embryology of Limulus (this journal for 1870), the development of Limulus is like that of certain other Crustacea with a condensed metamorphosis, the possession of an amnion being paralleled by that of Apus. In all essential points Limulus is a Crustacean, with some fundamental features in which it departs from the normal Crustacean type, and with some superficial characters in which it resembles the scorpion. The importance of these superficial characters Mr. Lankester exaggerates, and upon them with a number of suppositious, *a priori*, pseudo facts he constructs, by a process quite the reverse of the inductive method, a new classification of the Arachnida.

We will now briefly criticise some points insisted upon by Professor Lankester: and first on p. 510, as regards the ensheathing of the nervous cord by an actual arterial vessel. This is to be met with in a less marked degree in the insects (Lepidoptera) as well as scorpions. As regards the comparison of the nervous system of Limulus with that of the scorpion, the comparison and statement made in our second memoir, which Lankester sets aside, was based on a month's careful study and dissection of the nervous system, particularly the brain of the scorpion, while our author draws his inspiration from Newport's account and figures. The differences between the brain and thoracic ganglionic mass of the scorpion, and that of Limulus are not even correctly stated by our author. The brain of the adult scorpion, as we stated on p. 7 of our second memoir, sends off nerves to the simple eyes *and to the first pair of appendages;* in Limulus the brain supplies the eyes alone; the first pair of appendages being supplied from the

commissures, as in all Phyllopod Crustacea. Had Mr. Lankester examined for himself the brain of the scorpion, he would not have given the strangely incorrect account on p. 511. In the first place, the nerves to the first pair of appendages arise from the brain itself, as we have seen and as has been stated by other authors,[1] and not as Lankester says from the œsophageal collar. Moreover, as we stated, the brain is situated in the top of the head of the Arachnida, and not on the same plane as the œsophageal collar as in Limulus. In regard to the morphology (not the internal structure) of the brain, Limulus much more nearly approaches Apus and other Phyllopods than the scorpion and other Arachnida.

In discussing the external anatomy of Limulus, Mr. Lankester claims that between the sixth abdominal segment and the spine there are six segments. We venture to suggest that four of these segments are purely imaginary. Embryology, as we have indicated in our figures, shows that there are but nine segments in the abdomen of Limulus, the spine forming the ninth. Our author speaks of the "post-anal spine," when the anus is plainly situated in the base of the spine itself. It is a general law in the Arthropods that the anus opens in the terminal segment of the body. There are fifteen segments in the body of Limulus, as embryology abundantly shows. In order to compare the body of Limulus with its fifteen segments or arthromeres to that of the scorpion with nineteen, Mr. Lankester conjures up four additional segments, which are pure metaphysical inventions. The cephalothoracic plate or carapace is more than once styled a "sclerite." The author here (as usual) sets aside the embryological proof that the carapace is composed of the tergites of six segments, and allows, apparently as the results of his own independent observations (as if no one had previously *proved* it[2]), that

[1] Newport, whom our author quotes, expressly states that "immediately beneath the nerves to the eyes a large nervous trunk passes forwards, from the front of the brain on each side, to the small prehensile organs (*a*), which, in the scorpion, are modified antennæ." Balfour's embryological observations shows that originally the brain of the spider is a double ganglion; the two forming the adult brain; our embryology of Limulus shows that the brain is from the beginning a single ganglion.

[2] In a preliminary paper on the Embryology of Limulus Polyphemus, read before the Amer. Assn. Adv. Science, August 1870, and printed in the AMERICAN NATURALIST for October, 1870, which our author has apparently not seen, the six segments of the embryo Limulus when in the trilobite stage are figured, and the number of thoracic segments is stated in the text. This paper is a summary of the memoir printed in the Memoirs of the Boston Society of Natural History, and contains a general account of the embryology of Limulus, and appeared with figures over a year in advance of any other account of the embryology of Limulus.

the carapace may "be considered as representing six coalesced tergites." Partly on metaphysical grounds, and partly from the presence of moveable spines on the sides, which, however, are situated on the anterior limb-bearing segments of the abdomen, as well as on the 7th and 8th limbless segments, our author is encouraged in the belief that these four hypothetical segments really exist. We prefer the plain teachings of observed facts, which are capable of demonstration and proof, and would ask for better evidence than this article affords of the existence of such segments. We would also continue to regard the anal spine as the telson. Lankester's "telson" is made up of the consolidated thirteenth and fourteenth segments of the body *plus* the anal spine or fifteenth (or ninth abdominal) segment.

Our author sets out with the foregone conclusion that he "must" find in the "abdominal carapace" of Limulus the representatives of the twelve abdominal segments of the scorpion, and so with a method of his own he creates them out of his inner consciousness.

In like manner he feels compelled to offer a new interpretation of the scattered, individual, simple eyes of the scorpion, and attempts to show that after all they are compound eyes like those of Limulus, with the difference that in Scorpio they are "in a less compact form." Now the compound eye of Limulus, like that of the lobster or any other Crustacean or insect, possesses a common basally undivided retina, in Limulus a common undivided outer cornea, while the two simple eyes in Limulus have each a separate cornea, a separate retina, and each ocellus is supplied by a separate nerve arising independently from the brain.

In like manner our author labors to diminish the importance of the differences between the cephalothoracic appendages of the Arachnida and those of Limulus.

Professor Lankester then ventures, we think, somewhat hastily, to homologize the first pair of abdominal appendages of Limulus with a little triangular median sternite in the scorpion. Then he fancifully homologizes the comb-like organs of the scorpion with the second pair of abdominal legs of Limulus, and also homologizes the respiratory lamellæ with the "lamelliform teeth of the scorpion's comb-like organs." The author farther seriously attempts to homologize the four pairs of stigmata of the scorpion with the four last pairs of biramous respiratory feet of Limulus.

On the same principle the stigmata of any insect are the homologues of its legs. What will Mr. Lankester do with the gill-plates of the Eurypterida, which are not arranged, according to Woodward, like those of Limulus, but are placed like the teeth of a rake?

Another surprise is added to the already long list, by Mr. Lankester's discovery (of which he makes great account), of what he calls "parabranchial stigmata" in Limulus. He places them on the "sternal area of the segments," but his statements on the succeeding page, and his figures plainly show that these little muscular pits are situated at the base of the biramous abdominal legs. Is there an instance in nature of stigmata being borne on the legs? Is there the slightest possible reason for regarding these pits as stigmata? We are then treated to a long series of suppositions accompanied by a series of elaborate hypothetical lithographic drawings designed to "illustrate the hypothesis as to the derivation of the lamelliferous appendages of Limulus and Scorpio from a common ancestral form." The late appearance of the lamellæ on the feet of the embryo Limulus, should teach any naturalist of sound judgment that they are most probably very special and late differentiations of the appendages. Besides this, palæontology shows that in the Carboniferous period there were scorpions almost generically the same as the existing ones, and with them Bellinurus, closely resembling the Mesozoic and recent Limuli, which indicates that the latter type has always been a marine one, without any possible use for stigmata. Moreover, the Eurypterine Merostomata, with crustacean gills, flourished as early as the Lower Silurian period.

Passing over for want of space and time, the three or four pages of trivial criticisms of our own views by Professor Lankester, we are thus brought to the close of Mr. Lankester's article, and to his tabular view of his new classification of the Arachnida, one which is calculated at least to take away the breath of the ordinary systematist.

Any attempt at reasoning with our author, whose methods are so opposed to the inductive mode of scientific reasoning, and whose views are often founded on baseless hypotheses, would probably be fruitless. He is "surprised" that we should persist in believing that Limulus is a Crustacean.

We will in reply and to close this criticism, simply quote some

statements of the late Dr. Von Willemoes-Suhm, whose important discoveries have been overlooked by all writers on Limulus. Our attention has been called to them through Mr. E. Burgess by Professor Walter Faxon, who has kindly sent us the subjoined extracts from Von Willemoes-Suhm's Letters.

The first reference by Von Willemoes-Suhm was in the Zeitschrift für wissenschaftliche Zoölogie, XXIX, 1877, writing from Yeddo under date of May 7, 1875, he says: "I have in the meantime discovered in the Philippines that the Limulus living there develops from a free-swimming larva, viz., a Nauplius stage, a fact of great significance to the whole doctrine of crustacean development. The preliminary notice concerning it, which I soon send to the Royal Society, will soon come to your notice. Packard and Dohrn have had to do with an animal which, like the crayfish, has a condensed development." (p. CXXXII.)

A fuller statement is in a postscript to a letter written aboard the *Challenger* to Professor Kupffer, dated "Zamboanga, Mindaua, 4 Februar, 1875," printed in "Challenger-Briefe von Rudolf von Willemoes-Suhm, Dr. Phil., 1872–1875. Nach dem Tode des Verfasser herausgegeben von seiner Mutter," Leipzig, 1877, pp. 157, 158. I am indebted to Professor Faxon for the extract of which I give the following translation:

"I send you this postscript in order to forward early information that it has befallen to me to find on the surface of the water here, about five stages of development of *Limulus rotundicauda*, which does not, like the North American species, according to Packard and Dohrn, directly develop, but passes through a Nauplius stage, with one, afterwards with three eyes, wholly like a Phyllopod. A tail spine is present, but jointed above, and in this stage shows a parallel with Eurypterus. Packard's mode of development is a condensed one, and as would appear, his as well as Dohrn's and Van Beneden's generalizations on the position of Limulus are throughout untenable, in so far as they remove this from the Phyllopods *(Apus* and *Branchipus)*. They rather become closely allied through their common Nauplius with three pair of appendages; and a part of the 'Gigantostraken,' especially the Eurypteridæ, should be added to them."

"As soon as I reach Japan, I hope to also examine the Limulus there. The larvæ here are unfortunately very rare and difficult to isolate but I have good preparations of the most important stages. I hope to fall in with the northern species."

A PATHOGENIC SCHIZOPHYTE OF THE HOG.

BY PROFESSOR H. J. DETMERS.

(Continued from March number.)

A LITTLE over a year ago I had a chance to make an incidental investigation of a few cases of Texan fever, and besides other bacteria found several large bacilli, several micros in length. These bacilli developed large helobacteria, containing each one or two lasting spores. If the observations of others are correct, and I have no doubt they are, these lasting spores, when their time comes, burst, and discharge a cloudy mass, which is supposed to consist of exceedingly minute germs, too small to be distinctly seen with the very best objectives at our disposal. These minute germs, it is further supposed, develop and grow, and finally form the micrococci of the Schizophytes to which the helobacteria and the lasting spores belong. The helobacteria, which I found in swine-plague, bear, as to size, about the same relation to the swine-plague Schizophytes, as the helobacteria found in Texan fever to the bacilli, which presented themselves in that disease; consequently, as the former were found so often, and frequently in perfectly fresh material, before any other Schizophytes except those of swine-plague, and particularly before any putrefaction bacteria had made their appearance, there is, in my judgment, just cause to suppose that these helobacteria are but another stage of development of the bispherical swine-plague Schizophytes, and that the germs of the swine-plague micrococci are the product of the lasting spores. At any rate, if such is the case, the whole cycle of development and propagation is complete, and a great many things are at once explained which otherwise cannot be accounted for.

These lasting spores, undoubtedly, like those of some other Schizophytes, possess great vitality; are able to withstand degrees of heat and cold and other adverse influences absolutely destructive to the Schizophytes in any other form or stage of development. I have abundant proof—the same has been published in my reports to the Commissioner of Agriculture—that the vitality of the infectious principle of swine-plague, or what is the same, of the Schizophytes of swine-plague, can be preserved under certain conditions, or in certain media—in an old straw stack for instance—a whole year, and possibly much longer. If the swine-

plague Schizophytes did not develop helobacteria or lasting spores, such a long preservation, to say the least, would be difficult to comprehend, even if an indefinitely continued and uninterrupted propagation of the Schizophytes by fission should be possible, for an old straw stack, although affording excellent protection on account of its porosity, and by being a poor conductor of heat, does not seem to be capable of providing the necessary pabulum for innumerable generations for a whole year, or longer, without changing the malignant character of the Schizophytes, while, when cultivated in fluids, foreign to the body of the hog, the same Schizophytes undergo an observable change as to their malignancy—become less capable of producing mischief—in a few generations. Further, the swine-plague Schizophytes, while in the state of a single or double micrococcus, of a coccoglia, or of a micrococcus chain, are known to succumb in a comparatively short time to adverse influences, and it is very much to be doubted whether they possess vitality enough to be preserved a whole year, or longer, in a dormant state, even if protected by such a porous body as an old straw stack. Moreover, for reasons already stated, it would be impossible to account for the multitude of single micrococci invariably present in all infectious material, unless the swine-plague Schizophytes develop helobacteria and lasting spores, which produce germs developing to micrococci. If animal fluids, lung-exudation for instance, containing swine-plague Schizophytes, are filtrated through several papers, the latter, if fine enough, retain the micrococcus-chains, the zoöglœa-masses, most, or nearly all of the double, and a good many of the single micrococci, while some of the latter, no matter how fine the papers may be, will pass through. But as the single or spherical micrococci of swine-plague are not a product of fission — do not proceed from micrococcus-chain, zoöglœa-masses, or double micrococci—and do not come from other single micrococci, which, as far as I have been able to observe, develop to double or bispherical bodies, in as well as out of the zoöglœa-mass, the fact that in a few hours or, at any rate, in a day after the filtration, the number of single micrococci contained in the filtrate is much larger than immediately after the filtration, cannot be explained, unless something finer than the micrococci, in other words, some micrococcus germs or the products of the lasting spores, too fine to be distinguished by the human eye

through the best lenses in use, must have been contained in the lung-exudation, and must have passed through the filtering papers. Still, when the filtrate containing the micrococci, was filtrated again and again, each time through four papers, and at such a time, at which most or nearly all of the micrococci had become double, or developed to chains, but before any helobacteria had formed or could be found, the filtrate finally became free from micrococci, and an inoculation with the same proved to be ineffective, while an inoculation with the filtrate containing micrococci, produced a mild form of disease. Hence, it must be supposed, time and repeated filtrations finally exhausted the existing supply of micrococcus-germs or lasting spore products. Some French investigators, indeed, have found that in Anthrax not only the bacilli, but also their products (?), if used for inoculation, produce the disease. Does it not seem probable that these products are nothing but the germs discharged by the lasting spores, which are contained in the infectious media, invisible to the human eye even through the best objectives, because too small?

Finally, as single micrococci do not develop from other single micrococci, and are not a product of fission, they cannot increase in numbers in the animal organism—for instance, after an inoculation—unless we accept spontaneous generation, or unless there is another link in the cycle of metamorphosis, a helobacterium or lasting spore, which produces and disseminates the germs or seeds of the new micrococci. Therefore, as such helobacteria or lasting spores are of frequent occurrence, and can very often be found in perfectly fresh material, such as lung-exudation, blood serum, etc., before any other bacteria besides swine-plague Schizophytes have made their appearance, and also correspond in size to the swine-plague Schizophytes the same as the helobacteria found in Texan fever to the bacilli found in that disease, it will be pretty safe to conclude that the helobacteria in question are simply an advanced and matured form of the swine-plague Schizophytes. The discharged contents of such a lasting spore, though undoubtedly granular, are too fine to be resolved by our present objectives.

But what proof is there that these Schizophytes, which I call swine-plague Schizophytes, really constitute the cause and the infectious principle of that disease, and are not the products of

the morbid process, or merely accidental attendants. To show that their presence is not accidental, may not need much proof, although an abundance can be furnished. It will probably suffice to say, if the Schizophytes were accidental, that is, had no relation to the disease, neither as cause nor as effect, it would be very strange that they are found in every case of swine-plague and nowhere else. It may be said that some investigators did not find them, but that proves nothing. They are easily overlooked. If one, for instance, has blood or blood serum under the microscope, and focusses on the blood corpuscles, the microphytes, and especially the micrococci, are easily overlooked, particularly if the objective has a short focus and a large aperture, and therefore but little penetration, but the same will come into view if the focus is very slightly raised, or just enough to make the outlines of the blood corpuscles a trifle less distinct, because the Schizophytes, it seems, have a tendency to crowd as close to the cover as they possibly can. Some of them also crowd to the slide, and may therefore be brought to view by lowering the focus just a trifle. Besides, to distinguish under all circumstances, Swine-plague micrococci from small granules, and *vice versa*, requires some experience, a very good objective, good light and careful handling. Further, if one attempts to find Schizophytes in undiluted blood he will very often not succeed, because the blood corpuscles, if very thick or numerous, are apt to hide them from view.

In all my examinations of blood, blood serum, lung-exudation and other morbid products of swine-plague, I never found the swine-plague Schizophytes absent, while on the other hand, I never found them anywhere else. It is true I have found similar single and double micrococci and micrococcus-chains in other substances; for instance, in wine, but the same differed in size, and behaved differently in forming zoöglœa-masses and micrococcus-chains. Those which I found in some substances were considerably smaller, while in some others I found larger ones.

If the possibility of spontaneous generation is admitted, it will be difficult to advance direct proof that the swine-plague Schizophytes are not the product of the morbid process, because in a certain sense they are; they multiply within the animal organism, and multiply very rapidly, and probably in the same ratio, in which the morbid process progresses, if once introduced from the

outside. If, however, the possibility of a spontaneous generation is not admitted, the Schizophytes cannot be produced, or be called into existence by the morbid process.

As evidence that the swine-plague Schizophytes constitute the true cause of the morbid process, and the infectious principle of the disease, by which the latter is communicated from animal to animal, from herd to herd, and from one locality to another, I can offer the following facts, which may not constitute absolute proof, but, if considered in toto, make it reasonably certain that the Schizophytes, and nothing else, constitute the cause and the infectious principle of the disease.

1. Every inoculation of healthy pigs which never had become infected with swine-plague, when made with material containing swine-plague Schizophytes—lung-exudation for instance—proved to be effective, and produced the disease in due time, between three and fifteen days, or on an average in five to six days, notwithstanding the very small quantity, usually not exceeding the fourth part of one drop, with which the animal was inoculated on the outer surface of the ear, provided no measures of prevention were applied. For particulars I have to refer to my published reports. Further, even an inoculation with filtrated lung-exudation, in which no visible solid bodies whatever, except Swine-plague micrococci, could be discovered, proved to be effective, and produced a mild form of the disease, while filtrated lung-exudation, destitute of micrococci, when used to inoculate a healthy animal, proved to be ineffective, and did not even cause a visible reaction.

2. Inoculations with swine-plague Schizophytes cultivated in an innocent fluid, such as fresh cow-milk, albumen of a hen's egg, etc., invariably produced the disease, though usually in a comparatively mild form; a fact which corresponds with the results of the experiments, made by Toussaint, Pasteur, and Buchner with *Bacillus anthracis*, and by Pasteur with chicken-cholera microbes, and shows that the malignancy of pathogenic Schyzophytes depends largely upon the nature of this pabulum.

3. Swine, which survive an attack of swine-plague and recover, possess afterwards either perfect, or what is more frequent, partial immunity from further infection. In other words, subsequent inoculations, or a subsequent exposure to the influence of the infectious principle, have either no effect whatever, or have only a

comparatively slight effect, that is, are productive of a mild and not fatal form of the disease, or cause only a scarcely observable reaction. All this cannot find an explanation, if the infectious principle consists in a chemical virus, but is fully explained, if Schizophytes constitute the cause and the infectious principle of the disease, for it is a well known fact that these minute bodies, by passing through a certain cycle of changes or metamorphoses, and propagating to a certain extent exhaust in that medium, in which they are existing, the conditions necessary to their further development and propagation. They then render their medium sterile, and do not undergo any further changes, and do not multiply, unless, and until they are transferred to a fresh and otherwise suitable medium, when again they begin another cycle of metamorphosis and propagation, and multiply with great rapidity. In an animal, which has recovered from an attack of Swine-plague, some of the conditions necessary to the further metamorphosis and propagation of the Schizophytes, it seems, have become either partially or fully exhausted, and are not very soon restored, hence the partial, or as the case may be, perfect immunity. Still, as will be mentioned again, such an animal is usually able, at least within two months after its recovery, to transmit the disease, from which the same itself is not any more suffering, to other healthy animals, though in most cases only in a mild form.

4. It is a well known fact, and has been observed everywhere, not only by myself, but by nearly every one who has any experience in regard to swine-plague, that healthy hogs, which have access to a creek or a small stream of running water, which is further above accessible to, and defiled by, diseased hogs, or polluted with morbid products of swine-plague, or the carcasses of dead hogs, will almost invariably contract the disease; a fact which plainly shows to every thinking man that the infectious principle must be something corporeal, endowed with life, and able, like the swine-plague Schizophytes, not only to withstand the influence of water, but also to live and to multiply in the same. A chemically acting, and invisible fluid, or volatile virus, one should suppose, would become diluted by the water of a creek, small river, or running stream to such an extent as to be perfectly harmless and unable to communicate the disease, because there is no known chemical of an organic nature, but what

can be sufficiently diluted to lose its efficiency. With living germs it is different; if conditions are favorable, a few of them will suffice to develop innumerable generations, and may thus become a source of incalculable mischief. Further, it is also well known that the disease can be communicated through the air, and that the infectious principle which may happen to be floating in the air is absorbed by wounds, scratches, sores, abraisions, etc., in skin and mucous membranes, which would hardly be possible if a chemical virus constituted the cause and the means of infection.

5. The temperature of the atmosphere, and also the weather have considerable influence as to the spreading of the disease, but apparently have no influence whatever upon the morbid process or the development of the disease, after an animal has become infected. Frost, cold weather, lasting snow, frequent heavy rains, and continued drought and sunshine retard, and mild, warm and cloudy weather, heavy dews, and now and then a light rain considerably promote the spreading of the disease. Such would not be the case if the infectious principle consisted in a chemical virus, indestructible by water and air, but all this is natural, easily explained and self-evident, if living germs which require a certain degree of warmth and moisture, constitute the infectious principle, because frost, lasting snow, cold weather, heavy rains, and continued drought are inimical to organic life and vegetation, offer but little opportunity to the Schizophytes for a change of place, and necessarily retard their development and propagation; while, on the other hand, mild and warm weather, heavy dews, light rains, etc., are not only favorable to vegetation in general, and to the development of minute organic bodies in particular, but also offer a great many chances for a change of place and medium, and thus promote the propagation of the Schizophytes. The latter which are discharged in immense numbers with the excrements, urine, discharges from the nose, and other secretions and excretions of the diseased animals, rise into the air, perhaps mostly as micrococcus-germs and micrococci, probably only to a limited height, when the moisture contained in the dung and other excretions, and the urine evaporate, and come down again in the dew, and when it rains. At any rate, where swine-plague is prevailing, the swine-plague micrococci can often be found in dew-drops on the grass early in the morning, and also in exposed pools of

water. If the rain is a light one, the Schizophytes are apt to remain where the rain-drops deposit them, till evaporation once more carries them up into the air, but if the rain is very heavy or pouring, and temporarily flooding the ground, the Schizophytes, it seems, are washed away, for it can be observed that after light rains the spreading of the disease is accelerated, while immediately after each heavy or pouring rain a temporary diminution, often almost amounting to a cessation, can be noticed.

6. As already mentioned, it is an established fact that external wounds, especially such as are caused by ringing, castration, cutting of tails, and slitting of ears, external sores, scratches, and even abrasions, attract and absorb the infectious principle, and that the disease is also communicated, though not as readily as through wounds, etc., if the infectious principle is introduced with food or water for drinking into the digestive canal, while I have never yet been able to observe, or to obtain any evidence, that the infectious principle does enter, or can enter, the animal organism through a healthy skin, or through the respiratory organs, if the mucous membranes are in a perfectly healthy condition, or free from any sores, wounds, or abrasions. It has even been repeatedly observed that an animal whose skin and mucous membranes are whole and healthy, will not contract the disease, and is perfectly safe, if separated only by a fence, a board fence, or a board partition from diseased animals, provided, of course, an introduction of the infectious principle through the alimentary canal is prevented. All this shows that the infectious principle must be something that is very minute, but corporeal, and endowed with life and power of propagation, and not an invisible poisonous fluidum, for the latter, most assuredly, if dissolved in air, would find its way through the lungs, and, very likely also through the healthy skin into the animal organism.

7. If the morbid process is taken into consideration—for particulars I have to refer to my published reports, as going into details would consume too much time—it also becomes evident that something corporeal and endowed with life and power of propagation must constitute the cause of the disease. The morbid process in all parts and organs, in which it may develop, essentially the same, is best studied in the skin, subcutaneous tissues, and particularly in the lungs. At first the finer capillaries become obstructed, as a consequence, more or less blood serum transudes

through their walls into the tissues, or if the pressure is a great one some of the capillaries will yield, and become dilated or break behind the obstruction, and thus small specks of blood are extravasated. These extravasations are sometimes, especially in younger animals, exceedingly numerous, and present themselves as tiny red, or reddish-brown specks of the size of a pin's head, or smaller. To mention the further, or subsequent changes which are taking place, will not be necessary, for the same have but little bearing upon the subject. The question is what obstructs the capillaries? It, of course, must be something solid or corporeal, and I have not been able to find anything, except the swine-plague Schizophytes. It is true, the single and double micrococci, and the micrococcus-chains cannot and do not do it, for they are abundantly small to pass everywhere with the greatest facility where a blood corpuscle can pass, but these micrococci form zoöglœa-masses or coccoglia, which frequently are many times the size of a blood corpuscle, and therefore sufficiently large to clog the finer capillaries. Besides, some of the micrococci enter, or are taken up by the white blood corpuscles, and swell the latter not seldom to an abnormal size, or a size large enough to obstruct some of the finest capillary vessels. In all my examinations of diseased lung-tissue, and lung-exudation, these zoöglœa-masses and white blood corpuscles invaded by micrococci, have never been found missing, but always presented themselves in great, though somewhat variable numbers. No matter, in which way, or by what means the Schizophytes enter the animal organism, and get into the blood by being absorbed by the veins or by the lymphatics, the first capillary system to which they come, is in the lungs, which may account for the fact that in swine-plague morbid changes in the lungs, consisting in exudation, extravasation of blood, and finally hepatization are never absent. At least I found them at every post-mortem examination, and in the last three years I made about 300. Dr. James Law, of Ithaca, N. Y., in his report to the Commissioners of Agriculture, records the lungs of some of his experimental pigs as "healthy," "sound," "normal," etc., which simply shows that those pigs were *not* affected with swine-plague, and did *not* die of that disease. It may here also be mentioned that in all cases of swine-plague most of the lymphatic glands are more or less enlarged, and that comparatively more Schizophytes can be found

in the enlarged or swelled lymphatic glands, than in any other part of the animal's body.

8. In one and the same affected herd the older or more fully matured animals often recover, while nearly every young animal and particularly nearly every young pig under three months old, if once infested, will succumb to the disease, and is almost sure to die. This also may be considered as proof that the Schizophytes, or rather their zoöglœa-masses cause the disease by obstructing the capillaries. In older, and otherwise robust hogs the heart and the walls of the blood vessels are much stronger than in young pigs, and so it often happens that in the former the force of the blood current is strong enough to break and to disperse the zoöglœa-masses, and thus to free the obstructed passages, while in young, and especially in very young animals the pressure or the force of the blood current is insufficient, and then the passage is not freed, and exudation takes place, or the walls of the blood vessels are too weak, and then the latter yield and break and blood is extravasated. Usually both processes occur. Hence, while blood-extravasations in the lungs, are, as a rule, more frequent in young animals, other morbid changes brought about by Schizophytes, which have passed the capillary system in the lungs, and are forming their zoöglœa-masses in other parts or organs of the body, are on the whole more frequently met with in older hogs. Still, the latter, notwithstanding, have a much better chance of recovery than the former.

9. An animal which is recovering from an attack of swine-plague, or in which the morbid process has ceased to be active, will yet for sometime discharge swine-plague Schizophytes with its excretions, and is able to communicate the disease to other healthy animals by polluting their food or water for drinking, consequently the organism of such an animal is not destitute of the infectious principle, but contains an abundance of the same in a potent condition, while its own tissues have become sterile, or are not any more acted upon, because some of the conditions required by the Schizophytes to form zoöglœa-masses and to propagate have become exhausted. In the lungs of an animal which was butchered two months after recovery, I found an abundance of swine-plague Schizophytes, but no zoöglœa-masses. These facts, too, will be difficult of explanation, if a chemical poison or

virus, and not the Schizophytes constitute the infectious principle and the cause of the disease.

10. Swine-plague has a well-marked period of incubation, or as it has more appropriately been called stage of colonization, lasting from two to fifteen days, during which no morbid symptoms, with the exception, perhaps, of a somewhat higher temperature, can be observed. The average time which elapses after an inoculation or infection has taken place till plain symptoms of disease make their appearance, or till the morbid process has sufficiently advanced to produce external symptoms, or a visible disturbance of health, may be set down as from five to six days. All this is easily explained if Schizophytes constitute the cause, because those introduced from without are insufficient in numbers to cause at once important morbid changes; they must have time to undergo the necessary metamorphoses and to multiply within the animal organism, and this time varies according to the number of Schizophytes originally transferred to the condition or stage of development in which they are transferred, and to the degree of so-called predisposition or favorableness of conditions existing in the infected animal. As a rule, the larger the amount of the infectious material introduced and the richer the same in swine-plague Schizophytes, the shorter the period of incubation, or stage of colonization.

On the other hand, if the infectious principle were a chemical poison or virus, its action, one should suppose, would, under all circumstances be exactly the same, and the malignancy of the morbid process and the time required for its development would not be influenced by, or be dependent upon so many conditions, such as the individuality, age and temperature of the animal, the time and season of the year, the number and stage of metamorphosis of the Schizophytes contained in the infectious material and other yet unknown conditions. A poison or virus, indestructible by water and air, and not affected by dilution, no matter how far it may be carried, one should suppose, would act with great uniformity. Consequently one is obliged to conclude that the Schizophytes, and not a chemical virus, must, and do, constitute the cause.

11. The infectious principle undoubtedly consists in something that is destroyed and made ineffective by putrefaction, because infectious material, such as blood, blood serum, lung exudation,

other morbid products, etc., if putrefied, can be consumed by healthy animals without communicating the disease, and if used for inoculation, such putrefied material may cause septicæmia, but never produces a genuine case of swine-plague. Further, as has been previously mentioned, swine-plague Schizophytes cannot any more be found in the blood, blood serum, morbid tissues and morbid products, etc., of hogs which are diseased with, or have died of, swine-plague after putrefaction has set in, or in other words, after putrefaction bacteria, and particularly *Bacterium termo*, have made their appearance in large numbers. So, for instance, blood which has become sufficiently putrefied to assume a purplish color, is destitute of swine-plague Schizophytes. If these two facts are connected, it becomes evident that infectious substances or media lose their efficacy, or their power to communicate the disease to healthy animals simultaneously with the disappearance of the swine-plague Schizophytes, and *vice versa*, the latter disappear at the exact time at which the infectious substances or media cease to be infectious. Does this indicate a close relationship between the swine-plague Schizophytes and the infectious principle, or can such a remarkable coincidence be rejected as merely accidental? Further, is it more rational to accept as the cause and infectious principle of swine-plague, an unseen virus or something which nobody has ever produced, nor ever will produce, but which, notwithstanding, is indestructible by water, air and dilution, and possesses the remarkable property of making its exit at the *very* moment at which the swine-plague Schizophytes are destroyed, or caused to disappear by putrefaction, than to regard the latter, the Schizophytes, which do exist, are present, can be seen, have been shown and, moreover, possess all the properties and peculiarities manifested by the infectious principle, as the true cause of the morbid process and the propagators of the disease? I, for one should not think so.

12. It is an established fact that the morbid process, which invariably affects the lungs, will also develop in all such other parts or organs as may happen to be wounded, inflamed, or in a state of congestion—for particulars I have to refer to my reports—and thus some other parts besides the lungs may sometimes become just as much, or even more affected than the latter. So, for instance, if a pig has been ringed, or been castrated, and a perfect healing has not yet taken place when the animal becomes infected,

the parts yet more or less inflamed invariably become a prominent seat of the morbid process. All this is explained if the Schizophytes constitute the cause, as all recently wounded parts are comparatively rich in blood, and their capillaries, on account of the yet existing congestion or inflammation, are easily obstructed; but I should find it very difficult to give an explanation, if a poison or chemical virus constitutes the infectious principle and the cause of swine-plague. A chemical poison or virus, one should suppose, would possess special affinity to certain parts or tissues, and therefore cause the morbid process either to develop invariably in one and the same part of the body, or to attack in all cases the whole animal organism.

13. Antiseptics, or medicines, which are either directly poisonous to the lowest forms of organic life, or destructive to some of those conditions necessary to the metamorphoses and propagation of the simplest forms of organic life, such as Schizophytes, and among those antiseptics particularly carbolic acid, iodine, hyposulphite of soda, benzoate of soda, thymol, etc., have proved to be almost sure prophylactics. Their use, combined with strict separation, will prevent the outbreak of swine-plague in animals which have been inoculated or have undoubtedly become infected. As one of the conditions necessary to the development of swine-plague, it seems, must be considered a certain degree of animal heat. At any rate, after or while the animal heat of a pig is reduced by a continued treatment with carbolic acid from the normal 102 or 103° F., to an abnormally low temperature of a few degrees below 100—in several cases it was reduced to 96° and 97°—nearly every inoculation with fresh infectious material has proved to remain ineffective, and the few which did not remain ineffective were followed by an unprecedentedly long period of incubation and a very mild form of the disease. Comment will not be necessary. The various antiseptics which have proved to be good prophylactics, are very dissimilar in their chemical action and affinities, and therefore their prophylactic effect cannot very well be explained if the infectious principle consists in a chemical poison or virus, but admits explanation if something endowed with life and power of propagation constitutes the cause of swine-plague.

MEXICAN CAVES WITH HUMAN REMAINS.

BY EDWARD PALMER.

NEAR the western border of the State of Coahuila, Mexico, are to be found several caves in the limestone formation of the mountains. In these caves human remains were found. This section of country under consideration is commonly called the Lajona, which means overflowed. During the rainy season, which is the months of July, August and September, the river Nazas overflows its banks, and inundates the valley. Of late years cotton and corn has been cultivated. To prevent the excess of water from destroying the plants, large canals are dug round the fields, and connected with the river. These canals are used for irrigating the crops. Previous to the advent of the Spaniards this section could not have been much cultivated, as the good land was overflowed at the growing season, and previous to the rains it was too dry for crops to mature before the wet season, when the overflow would destroy them.

It presents to the eye of an observer a country unfit to sustain a large permanent people without modern appliances. Its numerous mountains are dry and rocky, without trees, though having a few stunty bushes and plants in the shady recesses. The valley also is as dry and barren except immediately about the receding waters. The plants naturally produced in a country of this character are the cactus, agave, yucca, mesquite, *Larrea mexicana*, and allied forms. These are either armed with thorns, or are so excessively bitter that neither wild nor domestic animals using them for food can exterminate them.

Animals are scarce; deer, two species of rabbits, skunk, badgers, ground squirrels, and rats, with snakes, lizards, birds and fish, are limited in number, except rabbits and blackbirds.

The food products of a country determines its capacity to sustain life, especially when without domestic animals, and situated as these people were in the midst of a desert waste without any productive country immediately near from which to draw food supplies from, moving from place to place as the food and water supply admitted during the dry season, in the wet they could with pack-animals move their effects to the near mountains in which water is then to be found. During the dry season there are but two plants in that section, which could be counted upon for a supply of food, game being merely incidental.

In the spring the center or crown of the agave was roasted, when it became a nutritious article of food, and in summer the mesquite beans are ripe. After the flood of waters had subsided, annual plants, like the sunflower, would produce abundance of seeds, which the inhabitants could return and gather.

As to the dead found in the caves, they had their knees drawn to their chin, also the hands, and so encased in their robes, and so securely bound with bands made of net-work, that they formed a convenient bundle for handling. Some had but one wrapping around the bones, others two; these during life were clothing and bedding, one worn round the waist and fastened by a belt; the other, worn over the shoulders, was fastened by two strings, attached thereto for that purpose. Those with only one wrapper, which was worn on the shoulders by day, wore around the waist in two parts appendages made of fringe or cloth; sometimes feathers were attached to the fringed ends to make the fringe longer and more showy; one division was worn behind the other in front. The heads of the dead were variously cared for. One had drawn over it a worked bag, another had a cap of net-work to which was fastened a profusion of feathers; this head rested in a collar of braided cat-tail rushes; other heads were placed in round pads that are usually worn on the heads of females to support the jars of water while carrying them. Sandals of various qualities were used, made of agave fibers. The ornaments worn were seeds of plants, vertebræ of snakes, roots of medical plants, pieces of shell, bone or stone cut into suitable shapes.

Caves as depositories of the dead were very suitable, and saved the labor of digging graves in the earth. In the caves the dead were laid therein without any earth being placed over them.

Raw materials for clothing was supplied mainly from the different agaves and yuccas; in fact, all the fabrics and sandals found with the cave dead were made from the fibers or leaves of those plants. Skins of animals seem only used to a limited extent for clothing, these plants furnishing a cooler and more durable fabric for hot climates.

The remains found in the cave have their hair done up in one bunch behind, and bound very tight by cords; they are very short in length, very unlike the hair of many of the Indians of the United States, whose hair hang down to and below their waists done up in two bundles, one on each side, larger than the bunch found with the cave dead.

The wooden handles and tools were cut by stone tools, and when they were required to be sharp, smooth and round, they were rendered so by rubbing with stones.

As no ruins of ancient dwellings are to be found in the cave district, it is to be inferred that they lived in dwellings of very perishable materials.

Baskets, plain and ornamented, were made from the split twigs of the Rhus or split roots of the mesquite bound over small rolls of grass. Dress goods were all made by hand-loom, or made of skins, and all garments of the same fashion were as plain as could be made. Only two pieces of pottery were found. If the war-like character of the people is to be inferred from the implements found, they should be considered very peaceable, for only two arrow-heads, parts of two bows, and one arrow shaft, to which is attached a piece of reed, having inserted in it a piece of a wooden arrow, the kind often used to kill small game; knives of fine finish made of stones, which by their size and shape would indicate they were used in cutting the maguey plant for roasting, and for dividing it after being cooked, were found.

For beds, small sticks and twigs of plants, over which were laid grasses, leaves, hides of animals, or mats, were used, as indicated by the remnants found in the caves. For covering by night, their clothing answered admirably, being long and of a width sufficient to cover them; their garments may be called long, narrow blankets, retaining their strength to the present time; bands, parallel lines or simple diamonds or squares were used in ornamentation. The colors used in dyeing are yet bright and perfect, being black, yellow, brown, red, and orange.

Easily constructed from the small pools, and sticks for the side and frame; for a roof, grass and earth, or yucca leaves were used. These simple huts were airy and cool, suited to the wants of a people living in a state of nature, and the requirements of a hot climate.

Are the native inhabitants of the country under consideration, descendants of those whose remains are found in the caves? Though they have been modified to some extent by the Catholic religion, and introduced customs from Spain, they present very much in their customs which compel the belief that they are yet more truly Indian than any thing else. They live in their simple huts with a household paraphernalia of Indians, often without the

least furniture. Beds, blankets, belts, shoes, baskets, crockery, hand-looms, and metates or stone mills with which they prepare their seeds and grain for food are still used, and the present inhabitants use many native plants and seeds for food that were used by the cave dead, while cotton and wool have taken the place of the agave and yucca fiber for clothing, and leather is substituted for plant fibers and leaves for shoes; it is only change of materials, not of mode of manufacture or superiority of workmanship that make a difference. The fiber of the agave though not now in use for clothing, is yet used to make ropes, mats, &c., the mode of preparing the fiber is handed down by cave people, and the knife now used for the cutting up of the agave plant for domestic uses though of iron, is fashioned after the stone knife found with the dead in the caves. As one sees the people in their domestic relations, in their daily avocations, when engaged in their dances, in their desire for idleness, taking into consideration all the above mentioned traits, one comes to the conclusion that they are the descendants of the cave people. The influence of the Catholic church has caused them to bury their dead in the ground. The present race not of Spanish origin is Indian.

Glancing over the physical geography and the natural productions of the country about the caves, the question may be asked, how high in the scale of advancement did the former inhabitants of this section rise? The clothing and utensils found with the dead answers the question. A race of Indians, without commerce, dependent upon the natural productions of a desert country to supply their daily want; long practice in the use of their simple arts had created that perfection, which has given rise to the belief that only a superior race could produce like results. A people in nature, in a climate with nine months drouth, without domestic animals and modern civilization could not become rich or civilized according to modern views. Studying closely this section with the evidences found with the cave dead, and comparing other lands with a similar production, and one finds there a like race with corresponding manners and customs. Take for instance ancient Peru and its people; the Territories of Arizona, New Mexico and Southern California with their inhabitants as found at the Spanish Conquest, and compare them with that portion of Mexico formerly inhabited by the race whose remains are found in the caves, and one will find not only a resemblance of produc-

tions from the soil, but the people possessing the same ability to take nature's gifts, and adapt them to their every day wants in a highly satisfactory manner. We are astounded in beholding their workmanship, they simply took nature's gifts and made the best of them. Comparing the cave clothing with that of the ancient Peruvians, we find a close alliance; both made by a hand-loom, the same as is used by the Indians of Peru, Mexico, Arizona, New Mexico and Southern California to-day. The rude Navajo Indian makes a blanket upon one of these hand-looms, which commands not only a good price from white men, but their admiration—yet he is considered a savage—lives in a hut. It is not necessary to live in palaces, in order to perform great works, and it is shown by our ancient and modern American Indians, that they were equal to emergencies, until compelled to face Europeans with their civilization.

In the New and Old World, it is customary to consider those that lived in caves to be a distinctive people from those called Pueblos or town-dwellers. The evidences of these kinds of habitations are to be found in many places. There was another class of dwellings: the perishable huts made of tree branches and thatched, of which nothing is left. The dwellers in each of these three classes of buildings might be of the same race. In the winter living in caves, in summer or while attending to crops they might live in temporary stick-huts. Some caves contain human remains, these have been put there as the easiest means of disposing of the dead. If surrounded by enemies, as the industrious and peaceful Indians of ancient times were, they had become Pueblos or dwellers in towns as a means of defence, yet they could be of the same people as the cave-dwellers, or those who inhabited brush houses. There was a distinctive race from the above which lived in brush huts; they lived by the chase, and roamed at will over the land, always warring against the town-dwellers. In some sections many stone implements are found, in others those of bronze. The finding of these tools of different materials is no evidence of their being made by distinctive people or in remote periods from each other, for sometimes one finds both together. Ancient and modern people in nature use whatever their section afforded. There is no reason to suppose that the so-called mound-builders were different from the cave-dwellers. Town-dwellers, makers of flint or bronze implements, they were all of

the same great division; *i. e.* buryers of the dead. Their war-like enemies compelled them to live in brush huts, built together in a wooded country in winter, and in the openings in summer; thus the mounds with human remains therein occur in these sections.

A difference in the kind of dwellings or tools do not of themselves warrant the conclusion of some writers that each distinctive class was an evidence of tribal or race difference. We might as well consider the makers of pottery a distinct people; but they were not, for every race of Indian made and used pottery in ancient times, and at the present time, even the warlike Indian, without fixed habitations, has his though of a plainer kind. There are some who think that the kind of pottery argues a different race origin; this is not so, the different qualities of pottery and forms are designed to suit the different purposes for which they were made, and not for a display of race distinctions. In Mexico and the United States in ancient times, the Indians used the same method of rendering their pottery hard and smooth as is now practiced by the Indians of Mexico to-day. A pebble of agate or jasper is used to rub over the surface of the pottery as soon as the new made article is dry; a fine, hard, smooth surface is the result; it has been considered a varnish. I saw it in general use; it is a new fact not known to writers before my visit to Mexico in 1877 and 1878.

In conclusion, I would say that there are two races of Indians to-day, as there were in ancient times, circumstances causing various interminglings, resulting in differences in manners and customs.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— Professor E. DuBois Raymond has recently delivered a lecture before the physicians of the German army, on exercise or use, in which he makes some important admissions. We hope to give an abstract of the lecture, but content ourselves, at present, with the following extracts: "We should be, therefore, free to admit, with some appearance of reason, that the vigor of the muscles of wings and of digging feet; the thick epidermis of the palm of the hand and of the sole of the foot; the callosities of the tail and of the ischia of some monkeys; the processes of

bones for the insertion of muscles; are the consequences of nutritive and formative excitation, transmitted by heredity." In this position Professor Raymond is in strict accord with the American school of evolutionists. He then goes on to say: "It is necessary to admit along with development by use, development by natural selection, and that for three reasons. First, there are innumerable adaptations—I cite only those known as mimetic coloration—which appear to be only explicable by natural selection, and not by use. Second, plants which are, in their way, as well adapted to their environment as animals, are of course incapable of activity. Thirdly, we need the doctrine of natural selection to explain the origin of the capacity for exercise itself. Unless we admit that which it is impossible to do from a scientific standpoint, that designed structures have a mechanical origin, it is necessary to conclude that in the struggle for existence, the victory has been secured by those living beings who in exercising their natural functions have increased, by chance ("par hasard") their capacity for these functions more than others, and that the beings thus favored have transmitted their fortunate gifts, to be still further developed by their descendants." In these three propositions, Professor Raymond still clings to the obscurities of the Darwinians, though Darwin himself is not responsible for them.

To take up first the second and third of these propositions. Professor Raymond does not for the moment remember that movement (or use) is an attribute of all life in its simplest forms, and that the sessile types of life, both vegetable and animal, must, in view of the facts, be regarded as a condition of degeneration. It is scarcely to be doubted that the primordial types of vegetation were all free swimmers, and that their habit of building cellulose and starch, is responsible for their early-assumed stationary condition. Their protoplasm is still in motion in the limited confines of their walls of cellulose. The movements of primitive plants have doubtless modified their structure to the extent of their duration and scope, and probably laid slightly varied foundations on which automatic nutrition has built widely diverse results. We may attribute the *origin* of the forms of the vegetable kingdom to three kinds of motion which have acted in conjunction with the physical environment; first, their primordial free movements; second, the intracellular movements of protoplasm; third, the movements of insects, which have doubtless modified the structure of the floral organs. Of the forms thus produced, the fit have survived and the unfit have been lost, and that is what natural selection has had to do with it.

The *origin* of mimetic coloration, like many other things, is yet unknown. An orthodox Darwinian attributes it to "natural selection," which turns out, on analysis, to be "hasard." The *survival* of useful coloration is no doubt the result of natural selection.

But this cannot be confounded with the question of origin. On this point the Darwinian is on the same footing as the old time Creationist. The latter says God made the variations, and the Darwinian says that they came by chance. Between these positions science can perceive nothing to choose.—*C.*

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RECENT LITERATURE.

THE DEVELOPMENT OF AMPHIOXUS BY HATSCHEK.[1]—The entire organic world does not contain a more interesting animal than the lancelet, Amphioxus or Branchiostoma, the lowest vertebrate, the link which, though far removed from either, indicates a common origin, or at least a remarkable structural similarity between the Vertebrata and the Ascidians or Tunicates.

The literature upon this creature, extensive but incomplete, is now enriched by the present exhaustive memoir by one of the most careful and accurate of European biologists. In this memoir, which forms the greater portion of a late issue of the *Arbeiten* of the Zoölogical Institute of the University of Vienna, and is illustrated by nine large plates, carefully drawn and colored, the development of the lancelet is traced with the greatest minuteness from the ovum to the adult. The ovum of Amphioxus contains, between the germinal portion and the enclosing membrane a remarkably large water space, forming by far the greater portion of its bulk, and the cleavage is very near regular, the difference between the size of the cells separated by the first equatorial fissure being very small. The "blastula" stage with its large segmentation cavity, and the gradual formation of a "gastrula," are abundantly illustrated; two plates are devoted to the more advanced development, plainly showing the hollow structure and alternate position of the muscle-plates or myocommas, and three colored plates are filled with transverse sections.

Until an advanced period of embryonic life, the digestive tract is continuous with a dorsal canal, which terminates at an opening upon the upper surface of the head. At a later period the vent is formed, connection between the digestive tract and the dorsal canal is cut off, the anterior opening closes, and the dorsal canal becomes the neural canal.

The hollow form of the muscular segments is shared by the lancelet with the Selachians (sharks and rays), Cyclostomes (hags and lampreys) and Batrachia, and tends to prove their primary origin as diverticula from the digestive cavity.

In the notochord vacuoles are developed, which become larger,

[1] *Studien über Entwickelung der Amphioxus.* Von B. HATSCHEK, pp. 88. 9 double 8vo plates. Arbeiten aus Zool. Inst. Univ. Wien und der Zool. Station in Triest. Tom IV. 1 Heft, 1881.

obliterating the structure of the original notochordal cells, until finally the notochord consists of a series of clear spaces separated by hyaline partitions. These vacuoles are traceable also in tunicates, and in the teleosts or bony fishes.

In conclusion, we have to say that Hatschek has given to the world a most valuable addition to its stock of embryological knowledge.

TROUESSART'S CATALOGUE OF RECENT AND FOSSIL MAMMALS.[1]—Catalogues of animal forms are as necessary to a student of zoölogy as are catalogues of books to the frequenters of a library, or directories to dwellers in cities. No zoölogist can carry in his brain, ready at an instant's notice, the accepted name, synonymy, etc., of all the species included in the department he specially studies, and thus such works as Gray's Hand-List of Birds, and the present are great boons to him; they save him hard work, and leave him free to exercise his mind upon purely scientific work.

Dr. Trouessart's catalogue, which has already progressed to the completion of the Primates and Rodentia promises to be to mammalogists what Gray's Hand-List is to ornithologists, with the added recommendation that it contains also all known species of fossil mammals, and will therefore prove equally useful to the palæontologist.

The classification adopted is to a great extent that of modern authors with the addition of the orders proposed by Professor Cope, and is based upon the structure of the feet and teeth, except in the division of all mammalia into the universally accepted sub-classes Monodelphia (placental) and Didelphia (non-placental).

The Prosimiæ (Lemurs) are separated as an order from the Simiæ; Cope's order Bunotheria, with four extinct sub-orders (*Mesodonta, Creodonta, Tillodonta, Tæniodonta*), and one recent sub-order (Insectivora), is placed among the *Secundates*, or unguiculates; the Toxodonta are considered a sub-order of Rodentia, and the Zeuglodonta has the same rank among the Pinnipedia. The line of hoofed animals or *Ternates* is concluded by the *Amblypoda*, with two sub-orders, *Dinocerata* and *Pantodonta;* the porcine group is separated as a sub-order from the ruminants, and the order Sirenia is intercalated between the Edentata and the Cetacea. The last mentioned three orders form the group *Homodonta*, of equal rank with the Heterodonta, which includes the remaining monodelphian orders.

The catalogue gives, besides genera, sub-genera, and species, the habitat, the synonymy, and all varieties on which species have been founded. When these varieties are merely local, or perhaps based on individual characters, they are marked with the

[1] *Catalogue des Mammifères Vivants et Fossiles.* Par le DR. E. L. TROUESSART. June, 1878.

letters a, b, c, etc., but these letters are doubled when the varieties have the weight of races or geographical species, while fossil species and genera are marked by the sign †.

There are points in the classification adopted that may reasonably be objected to. The most important of these is the creation of the group *Homodonta* to include the sirenians, whales and edentates, orders not closely allied, and differing much in the structure of the teeth.

The terms *Secundates* and *Ternates* are new, and are no improvement upon the older terms Unguiculata and Ungulata, the last of which should be understood to comprehend four orders, viz., *Proboscidea*, *Artiodactyla*, *Perissodactyla*, and *Amblypoda*. It is not possible to discover anatomical characters of sufficient importance to warrant the separation of the Bimana from the Simiæ, and it is probable that the Prosimiæ should be placed in the bunotherian series of sub-orders. This last probability is hinted at in the prospectus.

Bettany's Practical Botany.[1]—This useful little book should have been called First Lessons in the Practical Botany *of the Flowering Plants*, as it does not even mention the non-flowering plants. In the words of its author "its aim is to aid students in schools and colleges in the practical work of describing flowering plants." Some excellent suggestions are given under "How to Describe Plants." The "Cautions," too, are to the point. Under the successive topics, (1) Root system, (2) Stem and branch system, (3) Leaf system, (4) Inflorescence and floral receptacle, (5) Floral envelopes, (6) Stamens, (7) Pistil and ovules, (8) Fruit and seeds, short definitions and practical directions for the study of specimens are given, which if followed step by step will enable the pupil to observe accurately, and to record what he has seen in proper order and in plain language. Special directions are given in a later chapter for the study of the plants of the principal natural orders, which will doubtless prove useful to the student.

While we do not think it profitable to begin the study of botany with such complex organisms as the flowering plants, we nevertheless welcome this little volume because it can do good service in directing pupils to study *plants* rather than books on plants. The "laboratory method" is so fully carried out that the book can scarcely be studied by itself; the pupil *must* study the plant.—*C. E. B.*

Balfour's Comparative Embryology (Second Notice).—The chapter on the development of the birds is quite long, and the embryology of the chick has been more thoroughly studied than that of any other animal. In the brief chapter on reptiles, the de-

[1] First Lessons in Practical Botany, by G. T. Bettany, M.A., B.Sc., F.L.S. Macmillan & Co., London and New York, 18mo, 104 pp.

velopment of the lizard is chiefly discussed. In the longer chapter on the mammals, several pages are devoted to the early stages in the development of man.

The remaining two-thirds of the book are, in the present stage of embryological science, of much value to the student, as Professor Balfour here attempts the difficult task of stating the general conclusions derived from a survey of all authentic known facts regarding the embryology of animals in general. This is done successfully, the work well deserving the name of a comparative embryology.

In chapter XI, we are presented with a comparative sketch of the mode of formation of the germinal layers, and the notochord, with a notice of the mode of origin of the allantois and amnion. We notice here a little discrepancy in the author's statement regarding the allantoic bladder of the *Amphibia*, which leaves us somewhat in doubt as to the author's final opinion respecting its nature. On p. 108, the author states that the allantoic bladder of the frog "is probably homologous with the allantois of the higher Vertebrates;" on p. 587 he says that it "is homologous with the allantois of the amniotic Vetebrata," on p. 256, it is stated that there is "ample evidence" that the allantois "has taken its origin from a urinary bladder such as is found in Amphibia."

Chapter XII, observations on the ancestral forms of the Chordata, is mainly speculative. The author claims that it is clear from Amphioxus "that the ancestors of the Chordata were segmented, and that their mesoblast was divided into myotomes, which extended even into the region in front of the mouth. The mesoblast of the greater part of what is called the head in the Vertebrata proper was therefore segmented like that of the trunk." In the Amphioxus also the only internal skeleton present is the unsegmented notochord; a "fact which demonstrates that the skeleton is of comparatively little importance for the solution of a large number of fundamental questions." We have for some time inclined to the view that there was a general analogy between the head of an Arthropod and a Vertebrate, more intimate than generally stated, and Balfour's views on this point are of much interest. As to the differentiation of the Vertebrate head, he says on p. 260, "In the Chætopoda, the head is formed of a præoral lobe, and of the oral segment, while in Arthropods a somewhat variable number of segments are added behind to this primitive head, and form with it what may be called a secondary compound head. It is fairly clear that the section of the trunk, which, in Amphioxus, is perforated by the visceral clefts, has become the head in the Vertebrates proper, so that the latter forms are provided with a secondary head like that of Arthropods." Hence Balfour considers that the part of the head containing the fore-brain is probably "the equivalent of the

præoral lobe of many Invertebrate forms, and the primitive position of the Vertebrate mouth on the ventral side of the head affords a distinct support for this view."

Gegenbaur's theory that the pairs of cranial nerves represent so many segments, and his segmental theory of the skull, which has replaced the old-fashioned vertebrate theory of the skull, is apparently endorsed by Balfour, who states that "the posterior part of the head must have been originally composed of a series of somites like those of the trunk, but in existing Vertebrates all trace of these, except in so far as they are indicated by the visceral clefts, has vanished in the adult. The cranial nerves, however, especially in the embryo, still indicate the number of anterior somites," etc.

Part I is concluded by a chapter on the mode of origin and homologies of the germinal layers of animals in general, and with a discussion of larval forms.

Part II, or the second half of the book is devoted to *Organogeny*, or the mode of origin of the different organs of the vertebrate body, and this important part is characterized by the same full, critical treatment as in the first part, with consideration of the theoretical bearings of facts, such as seem at least in the main warranted by our present knowledge of the facts.

The work is a most stimulating one, and will greatly advance in English-speaking countries the study of what is the most difficult field of research in biology.

ELLIOTT'S SEAL ISLANDS OF ALASKA.[1]—This entertaining and unusually well illustrated monograph of the fur-seal, hair-seal, sea-lion, and walrus is exceptionally well done. The story is really a fascinating one, and the author's sketches of these animals in various ages and altitudes are apparently by far the best that have ever been executed. A number of important hitherto doubtful points have been cleared up by Mr. Elliott, especially those relating to the breeding habits of these creatures. The report, while of particular economic value, is also one of the most important works on natural history which has been published by our Government, containing as it does the results of several years of arduous study and close observations on the bleak, out-of-the-way Prybilov group of islands.

Although the seal is not a fish, the volume not inappropriately appears as a special Bulletin under the direction of the Commissioner of Fish and Fisheries.

[1] U. S. Commission of Fish and Fisheries. Spencer F. Baird, Commissioner. 176. Special Bulletin. A Monograph of the Seal Islands of Alaska. By Henry W. Elliott. Reprinted with additions, from the report on the Fishery Industries of the Tenth Census, with engravings and maps. Washington, Government Printing Office, 1882. 4to, pp. 176

RECENT BOOKS AND PAMPHLETS.—Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs, in wort u. Bild. Von C. H. Hoffmann. Sechster Band III Abtheilung—Reptilien 25 u. 26 Lieferung. 8vo, pp. 79, 4 plates, colored. Leipzig und Heidelberg, 1881.

Papers by Dr. W. Peters in the Sitzungs-Bericht der Gesellschaft naturforschenden Freunde zu Berlin.

1. Mittheilung über vier neue Fische. 15 February, 1881.

2. Uber das Vorkommen schildförmeger Verbreiterungen der Dornfortsätze bei Schlangen und neue oder Weniger bekannte Arten dieser Abtheilung der Reptilien. 15 Marz, 1881.

3. Uebersicht der zu den Familien der Typhlopes und Stenostomi gehörigen Gattungen oder untergattungen.

4. Uber eine neuen Art von Tachydromus aus dem Amurlande.

5. Uber die von Herm. Dr. Finsch aus Polynesien gesandten Reptilien. 19 April, 1881.

6. Uber drei neue Eidechsen, zu der Familie der Scincoiden gehörig, eine Lipinia (Mit geckonenähnlicher Bildung der Zehen!) aus Neu-Guinea und zwei Mocoa aus Neuholland. 17 Mai, 1881.

7. Uber die Excrescenzen des Männchens von Rana gigas Blyth (=Rana liebigii Günther), während der Poarungszeit.

8. Uber zwei Arten der Schlangengattung Psammophis und über die synonymie von zwei Arten der Lycodonten.

9. Uber den Bau des Schädels Uræotyphlus oxyurus (Dum. Bibr). 21 Juni, 1881.

10. Uber die Verschiedenheit von Syngnathus (Belonichthys) zambezensis Pths., und S. (B.) mento Blecker, und über eine neue Art der Schlangengattung Callopsis von den Philippien.

11. Die Beschreibungen von neuen Anneliden des zoologischen Museums zu Berlin, welche sich in dem Nachlasse des Staatsraths Prof. Dr. Grube in Breslau gefunden haben, der ihm von der Frau Staatsräthin Grube Mitgetheilt War. 19 Juli, 1881.

12. Uber die von Herrn Major von Mechow von Seiner letzten Expedition nach Westafrika Mitgebrachten Säugethiere und legte darunter ein Wohlerhaltenes Exemplar der merkwürdigen Insectivorengattung Potamogale (P. velox Duchaillu) vor. 18 October, 1881.

13. Zwei neue von Herrn Major von Mechow Während seiner letzen Expedition Westafrikas entdeckte Schlangen und eine Uebersicht der von ihm Mitgebrachten herpetologischen Sammlung. 15 November, 1881.

14. Uber die Verschiedendeit der Lenge der äusseren Spalten der Schallblasens Merkmal zur Unterscheidung besonders Afrikanischer Froscharten. 20 December, 1881. Berlin, 1882. From the author.

Uber die Chiropterengattung Mormopterus und die dahin gehörigen Arten. W. Peters. 8vo, pp. 6, 1 plate. Auszug aus dem Monatsbericht der Königl. Akademie der wissenschaften zu Berlin. 19 Mai. Berlin, 1881. From the author.

Palæontographica. Beiträge zur Naturgeschichte der Vorzeit. Wilhelm Dunker und Karl A. Zittel. Achtundzwanzigster Band. Der dritten Folge Viertes Band, Dritte Lieferung. Die Medulloseæ. Eine neue Gruppe der Fossilen Cycadeen. Von Dr. H. R. Göppert und Dr. G. Stenzel. 4to, pp. 40, 10 plates. Nov. 1881. Die Fauna des Kelheimer Diceras-Kalkes. (Zweite Abtheilung.) Bivalven von Dr. Georg Boehm. 4to, pp. 130, 26 plates. (Vierte und fünfte Lieferung.) December, 1881. Mittheilungen über die Structur von Pholidophyllum loveni E. und H., und Cyathophyllum sp. ?, aus Konieprus. Von G. von Koch. 4to, pp. 37, 6 plates. (Sechste Lieferung.) Jan., 1882. Cassel, 1882. From the publishers.

Undersökningar öfver Molluskfaunan. I Sveriges Aldre mesozoiska Beldningar, af Bernhard Lundgren. 4to, pp. 37, 6 plates. Aftryck ur Lunds univsitetes Arsskrift. Tom. XII. Lund, 1881. From the author.

Studien über die Fossilen Reptilien Russlands. Von W. Kiprijanoff. (Gattung Ichthyosaurus König. aus dem Severischen Sandstein oder Osteolith der Kreide-

Gruppe.) 4to, pp. 106, 19 plates. From Memoires de L'academie Imperiale des Sciences de St. Petersbourg. St. Petersburg, 1881. From M.

Du Role des Courants Marins dans la déstribution geographique des Mammiféres Amphibies et particulierement des Phoques et des Otaries. Par le Dr. E. L. Trouessart. 8vo, pp. 4. Extrait du Bull. de la Societie d'Etudes Scientifiques d'Angers (Anne, 1881). Paris, 1881. From the author.

Association Française pour L'avancement des Sciences, Congres de Reims. La Grotte de l'Albanea. 8vo, pp. 8, 4 plates.

Nouvelles Recherches dans les Alpes-Maritimes en 1879. M. Emile Riviere. 8vo, pp. 10. Paris, 1880. From the author.

Deux Plesiosaures du Lias Inferieur du Luxembourg. Par P. J. Van Beneden. 4to, pp. 46, fol. plate. Extrait du Tome XLIII des Memoires de l'Academie royal des Sciences, des letters et des beaux-arts de Belgique, 1881. Brusells, 1881. From the author.

Polacanthus foxii, a large undescribed Dinosaur from the Wealden formation in the Isle of Wight. By J. W. Hulke, F.R.S. 4to, pp. 14, 7 plates. From the Philosophical Transactions of the Royal Society. Part III, 1881. London, 1881. From the author.

List of the Geological Society ot London, November 1, 1881. 8vo, pp. 79. London, 1881. From the society.

Report on the mode of Reproduction of certain species of Ichthyosaurus from the Lias of England and Wurtemberg, by a committee consisting of Professor H. G. Seeley, F.R.S., Professor W. Boyd Dawkins, F.R.S., and Mr. C. Moore, F.R.S. Drawn up by Professor Seeley. 8vo, pp. 8, fol. plate. Reprint from the Report of the British Association, 1880.

The following is a list of papers by Professor H. G. Seeley, extract from the Quarterly Journal of the Geological Society :

Note on the Cranial characters of a Teleosaur from the Withby Lias preserved in the Woodwardian Museum of the University of Cambridge, indicating a new species, Teleosaurus eucephalus. 8vo, pp. 8, quarto plate. Nov., 1880.—

On the skull of an Ichthyosaurus from the Lias of Withby apparently indicating a new species (I. zetlandicus Seeley), preserved in the Woodwardian Museum of the University of Cambridge. 8vo, pp. 16, quarto plate. Nov., 1880.—

Note on Psephoporus polygonus V. Meyer, a new type of Chelonian reptile allied to the leathery turtle. 8vo, pp. 10, plate. Aug., 1880.—

On the remains of a small lizard from the Neocomian rocks of Comén, near Trieste, preserved in the Geological Museum of the University of Vienna. 8vo, pp. 6, plate. February, 1881.

The reptile fauna of the Gosau formation, preserved in the Geological Museum of the University of Vienna, with a note on the geological horizon of the fossil at Neue Welt, west of Wiener Neustadt. By Edw. Suess, Ph.D. 8vo, pp. 82, 5 fol. plates.

The history and present condition of the Fishery Industries. The Oyster Industry. By Ernest Ingersoll. 4to, pp. 252, 22 plates, cuts. Department of the Interior. Tenth census of the United States. Government Printing Office, Washington, 1881. From the department.

A monograph of the Seal islands of Alaska. By Henry W. Elliott. 4to, pp. 176, 39 plates, cuts. U. S. Commission of Fish and Fisheries. Government Printing Office, Washington, 1882. From the commissioner.

GENERAL NOTES.

BOTANY.[1]

MOTILITY IN THE FLOWERS OF DRABA VERNA.—As is well known this plant flowers during any open time in spring, say from February to June, with us. In the early part of the season the petals expand about 9 A. M. and close about 2 P. M. Surprised that I had not noticed this opening and closing years before, I was led to observe it from day to day, and many times a day. If there was the least cloudiness, no matter how great the volume of light, the petals would not expand. During nearly a week of cloudiness no flowers expanded. On the least burst of sunlight, however, the flowers opened, provided always, it was before 2 P. M. I felt little hesitation in deciding that sunlight was the immediate agency in expansion. One day we had a heavy thunder shower. The next day was wholly cloudy, but strange to say they expanded during this warm moist cloudy day, as well as under the previous sunlight! They seem to expand every day since, sunlight or not, through all these variations, however, up to to-day they close regularly about two o'clock. To my mind it leaves the cause of motion more obscure than ever. It is evidently not light alone, and it is a gain is know what it is not. Yet if we had reflected we might have learned this lesson before, for there are some flowers opening at every hour of the twenty-four. Under the same light when one expands another may be closing; what is one man's meat is another one's poison. It is not the food, but the internal arrangements, it is not the light, but the ability to make use of it.—*T. Meehan, May 7th, 1881.*

NEW WORK ON THE FUNGI.—Prof. Saccardo writes me that the first part of his *Sylloge Fungorum Omnium* is now in press and will soon be ready, embracing the *Erysipheæ*, *Perisporiaceæ* and *Capnodiæ*. This will be followed by the *Sphæriaceæ*, so that it is expected all of the Pyrenomycetes will be finished this year.

It will be recollected that the Sylloge is to include diagnoses of all the species of fungi published up to the present time, thus doing to some extent for the fungi, what De Candolle's Prodromus is doing for the Phanerogams.

The importance of such a publication will at once be evident, bringing together and rendering accessible the *disjecta membra* of mycological literature, which, lying as it now does scattered through various publications and in the transactions of the scientific societies in different parts of the world, is to the ordinary student for the most part inaccessible.

The work can be obtained by addressing Professor P. A. Saccardo, Padova, Italy. The expense will be from eight to ten dollars per year, and the work will require probably four years for completion.—*J. B. Ellis, Newfield, N. J.*

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

DE THÜMEN'S MYCOTHECA UNIVERSALIS.—This valuable mycological collection, which was begun in 1875, now includes 2000 species; the 20th century having been issued towards the close of 1881.

The work is very neatly gotten up, and including as it does species from all parts of the world, many of which are rare and valuable, is well worth the moderate price at which it is sold.

An index to the first twelve centuries has been published, from which it may be noted that among these 1200 species there are of the

Hymenomycetes	105
Discomycetes	60
Sphæriacei	185
Uredinei	300

These different orders are apparently represented in about the same relative proportion in the remaining centuries of the collection (XIII–XX).

The preponderance of the Uridinei is noticable, comprising as it does one-fourth of the whole number of species. Of these 237 were collected in Europe, 33 in America, 21 in Africa, 7 in Asia, and 2 in Australia.

The bulk of the species, as would be expected, are European, but as at least three collections at different points in the Middle and Southern States have contributed more or less, the proportion of American species is comparatively very small and naturally leads to the enquiry whether the Uredinei are really represented by a less number of species here than in Europe.

That this may be the case is further indicated by the fact that in the "North Am. Fungi" of which the material for nine centuries is now collected, there are, after throwing out from cent. III 25 species not belonging to this order and adding 50 species since collected, only 125 species of Uredinei or about $\frac{1}{7}$ part of the whole number thus far collected.

It is to be borne in mind, however, that in the Report of the N. Y. State Museum of Nat. History, nearly 200 species of Uredinei have already been enumerated, and it is altogether probable that on a thorough exploration of our territory, the list of American species of this order will be largely augmented.—*J. B. Ellis, Newfield, N. J.*

NOTES ON N. AMERICAN GRASSES, BASED ON MR. BENTHAM'S RECENT PAPER ON GRAMINEÆ.—

Series 1st—PANICACEÆ.

Polypogon is placed by Mr. Bentham in this series because of the disarticulation of the spikelets below the glumes. Otherwise its relationship is with Agrostis.

Thurbera, a new genus by Bentham, to include two N. A. species which have been variously referred to Limnas, Greenia, and Streptachne. The first named is an Arctic grass to which ours are not related, and the two other names are preoccupied. The genus is very properly named after Prof. Geo. Thurber, as "the genus formerly dedicated to him by Asa Gray, has since proved not to be distinct from Gossypium."

Pleuraphis Torr., is very properly referred to Hilaria H.B.K. Mr. Bentham says our Texan species, which has been called *Hilaria cenchroides* H. B. K., is apparently distinct.

Ægopogon is placed in Panicaceæ.

Andropogoneæ is subdivided into four groups or sub-tribes: Saccharеæ, Arthraxeæ, Rottbœllieæ and Andropogoneæ proper. Saccharеæ comprise seven genera: Imperata, Miscanthus, Saccharum, Erianthus, Spodiopogon, Pollinia and Pogonatherum; the second and seventh not represented in N. America. The group Arthraxeæ also not represented in N. America.

Rottbœlliaceæ. The American genera of this group are Elionurus, Rottbœllia and Manisuris. *Andropogon Nuttallii* Chap., is an Elionurus nearly related to *E. ciliaris* H. B. K.

Euandropogoneæ compose nine genera, of which we have Ischæmum (introduced), Trachypogon, Heteropogon, Andropogon, Chrysopogon and Sorghum. Andropogon is divided into five sections: Schizachyrium, Cymbopogon, Gymnandropogon, Amphilopsis and Vetiveria. Our species of Sorghum, as *S. nutans* and *S. arenacea*, are species of Chrysopogon. Sorghum includes only the cultivated *S. vulgare* and *S. halapense*.

Series 2d—POACEÆ.

Tribe 1st—Phalarideæ: Phalaris, Anthoxanthum and Hierochloa.

Tribe 2d—Agrosteæ. We have Aristida, Stipa, Oryzopsis (which includes Piptatherium and Eriocoma), Millium, Muhlenbergia (which includes Vaseya and Podosæmum), Brachyelytrum, Perieilema, Lycurus, Phleum, Coleanthus, Phippsia (an Arctic genus) and Sporobolus. Sporobolus includes Vilfa, Beauv. In this tribe we have also Epicampes, which includes *Cinna macroura* Thurb. (which is not *E. macroura* Kunth, but *E. rigeus* Benth). Of Cinna we have two species, *C. arundinacea* and *C. pendula*.

In Deyeuxia are included all our species of Calamagrostis except two or three which go into Ammophila Host. Arctagrostis is an Arctic genus of this tribe.

The tribe Isachneæ is represented in the West Indies and perhaps in Mexico.

Tribe Aveneæ—16 genera. All our native species of Aira are referred to Deschampsia.

Tribe Chlorideæ—27 genera. Chloris includes Eustachys Desv. Trichloris Fourn. includes two Texano-Mexican species.

Lepturus paniculatus Nutt., is referred to Schedonnardus Steud.

Bouteloua has four sections: Chondrosium, Atheropogon, Triathera and Polyodon. Eleusine includes Dactylotænium Willd.

Leptochloa dubia and *L. fascicularis* are referred to Diplachne in the tribe Festucaceæ, as also the following:

Triodia includes Uralepis and Tricuspis. Triplasis Beauv. has two N. American species. Stenochloa Nutt., is now Dissanthelium Trin. Pleuropogon Br., includes Lophochlæna Nees. Our Brizopyrum is Distlichlis Raf. Briza includes Calotheca Desv. Graphephorum Desv., contains seven species, as arranged by Dr. Gray. Atropis Rupt., is referred to Glyceria. Bromus includes Ceratochloa D. C.

Hordiaceæ; Our native Triticums are referred to Agropyrum. Gymnostichum Schr., or Hystrix Moench., is referred to Asprella Willd.

—*Geo. Vasey, Washington, D. C.*

BOTANICAL NOTES. — Romyn Hitchcock, of New York, has merited the gratitude of botanists by undertaking the publication of Habirshaw's "Catalogue of the Diatomaceæ," which contains full references to the published descriptions and figures. Every botanical library should secure a copy of this valuable work at an early date, as the edition is limited to two hundred and fifty copies. Part 1 of this work has just appeared.—— The same publisher has on sale Dr. Henri Van Heurck's "Synopsis des Diatomées de Belgique," of which four of the six fascicles have appeared. The excellent plates which constitute the substance of the fascicles include many hundred

species, a large proportion of which are common in our waters. This work, with the catalogue noted above, will go far to render easier the systematic study of the diatoms.——Professor C. H. Peck re-describes, in the January *Torrey Bulletin*, a curious fungus, *Secotium Warnei*, which constitutes "a connecting link between the Hymenomycetous Agaricini, and the Gasteromycetous Trichogasters." The close resemblance of some of the stipitate forms to an unexpanded Agaric was, in specimens from Iowa, quite remarkable, and the writer of this note was for a time puzzled to determine whether it might not be an Agaric after all.——The Forestry Bulletins issued from the Census Office, and prepared by Professor Sargent, are of great interest and value to botanists. When the series of bulletins is completed we shall have a most excellent and reliable map of the forest distribution of the United States.——Wiley & Sons, of New York, have, at the request of some of their patrons, reprinted the edition of "Lindley's Horticulture," which they brought out many years ago, and which had long been out of print. We are glad to see the old book again, and hope that ere long it may be honored with a revision, bringing it up to the present status of vegetable physiology.

ZOÖLOGY.

THE CELL-PARASITE OF THE FROG.—The *Revue Scientifique*, of January 28, 1882, contains an abstract of the discovery by Dr. Gaule, in the frog's red blood corpuscle, of certain bodies which he considers to be derived, under certain circumstances, from the protoplasm of those corpuscles. On treating the red corpuscles with a solution of six per cent. of chloride of sodium, there appeared, beside the nucleus, mobile corpuscles, elongate and pointed at the extremities. These issued from the cell, which they could drag after them for some time, but after a little while became motionless, and finally died and disappeared.

These mobile particles are not met with in all frogs, the season, locality, size, and general state of the animal seeming to have considerable influence on their production, which is most abundant in the season when the frog takes no food, and depends for sustenance upon the reserves stored up in the season of activity. In the cells of such organs as the spleen, the liver, and the marrow of the bones, these particles develop at the expense of the red blood corpuscles more easily and quickly than in the blood itself, and they are more readily obtainable from the spleen than from any other organ. The addition of the saline solution to the sugar of that organ, without the application of heat, caused them to appear. When the violet of gentian was added to the solution only these bodies and the nucleus were colored and this fact led Gaule to suspect that they were derivatives of the nucleus.

In a last series of observations, Dr. Gaule experimented on tissues taken from the living animal. When these were treated with a solution of corrosive sublimate or of nitric acid of three

per cent., bodies which he considered identical with those before spoken of were found, like little accessory nuclei, and these behaved with coloring reagents in precisely the same manner as nuclei. Dr. Gaule states that if the cellules of *fresh* tissue are disassociated by means of osmic acid, these bodies do not appear; but if the cellules are dead, these bodies can be preserved in osmic acid.

Dr. Gaule's observations were originally published in two articles in the *Archiv für Physiologie;* the first article without figures, the second illustrated.

He first named the bodies "little worms" *(Würmchen)* but afterwards gave them the title of Cytozoa, and his ultimate conclusion as to their nature was the singular one that they are the *result of death*, one portion of the protoplasm dying, while the other *becomes more active*, frees itself from the dead portion and survives awhile. It is probable that the first name given by Gaule foreshadowed the true nature of these bodies.

Professor E. Ray Lankester (Quar. Jour. Mic. Sci., 1882, 53) considers these bodies to be cell-parasites. He says that in 1871 he described in the same journal certain sausage-like parasites from the blood of *Rana esculenta*, and suggested that they might be connected with the life-cycle of *Trypanosoma sanguinis* (Gruby), at the same time pointing out their resemblance to certain peculiar spores found in cysts of a gregarine parasitic in *Tubifex*.

As Dr. Gaule gave no figures in his first article, it was supposed that he had been studying some of those curious phenomena of disintegrating blood-corpuscles that attract the attention of histologists; but the figures accompanying the second paper showed at once that they were cell-parasites belonging to the Gregarinidæ and identical with the organisms described by Lankester in 1871. Certain Gregarinidæ (Sporozoa) are now known to be cell-parasites during a portion of their lives, and those organisms have of late been considerably studied. One of these sporozoa *(Gregarines velues)* inhabits the sperm polyblasts of the earth-worm. Butschli has shown that sometimes the gregarines of the earth-worm penetrate epithelial cells of the ciliated funnels of the spermatic duct, and will continue attached to the cell by one extremity when they have attained fifty times the linear dimensions of the cell.

Eimer observed oviform psorosperms *(Coccidium* Leuckart*)* in the house-mouse, and Aimée Schneider has discovered in the pseudonaviculæ of *Monocystis lumbrici* and other gregarines falciform corpuscles resembling those figured by Gaule. Schneider's observations establish the relationship between these curious bodies, such as Eimer's *Coccidium*, and the typical gregarines.

The bodies found in the frog resemble Eimer's *Coccidium* of the mouse both in form and size; and also bear a close likeness to the falciform corpuscles found in the spores of a gregarine which occurs in the striated muscular fibers of the pig, sheep

and man. The cattle plague of 1865 was at one time attributed to this gregarine.

Taking into consideration all these points, Professor Lankester believes the bodies found by Gaule, and afterwards again observed by himself, to be a stage in the life-cycle of a gregarine to which he gives the name of *Drepanidium ranarum*.

Professor Lankester disposes of Gaule's statement that these bodies were formed on the stage of the microscope after the application of the saline solution; as well as of that observer's failure to discover them in living tissue, by showing that it is difficult to see the nucleus in living tissue, so much so that not long ago it was thought that the red blood-corpuscle of the frog contained no nucleus during life. The parasite is difficult to see because its angle of refraction is the same as that of the corpuscle, but it becomes visible *just at the same time and to the same degree* that the nucleus does.

Dr. Gaule's studies, however, establish two facts not before known; these are, 1st, that the parasite is not only found *attached* to the cell, but also *within* it; 2d, that it is capable of active movement by bending and straightening its body; these movements are excited by a heat of 30°–35° C., but are stopped by a heat of 70° C.

The active motions of these bodies, exhibited in cells as well as in fluids; the cessation of these movements at a temperature of 70°; the fact that they are found in some frogs and not in others, as well as at some seasons and not in others; their power to penetrate cells and escape from them; and their presence in *R. temporaria*, as well is *Triton*, sp., all point to their animal nature.

To Gaule's assertion that these bodies did not appear in fresh tissue, Lankester opposes the statement that he obtained them from spleen pulp spread when fresh in osmic acid, and suggests the possibility that the particles treated in this manner by Dr. Gaule were free from the parasite, while those treated otherwise contained them.

Vitality of the Mud Puppy.—The observations on the Menopoma in your February number, call to mind several instances of its remarkable vitality which have come under my own observation. One specimen, about eighteen inches in length, which had lain on the ground exposed to a summer sun for forty-eight hours, was brought to the museum, and was left lying for a day longer before it was placed in alcohol. The day following, desiring to note a few points of structure, I removed it from the alcohol, in which it had been completely submerged for at least twenty hours, and had no sooner placed it on the table before it began to open its big mouth, vigorously sway its tail to and fro, and give other undoubted signs of vitality.

On another occasion desiring to kill one of these creatures,

which had been out of water for a day, I made a little slit in the back, hoping to be able to penetrate between the cervical vertebræ with a stout scalpel, and cut the spinal cord. After several trials, in which I succeeded only in breaking the scalpel, I gave up the attempt; but with all my cutting and pushing, it manifested not the slightest signs of pain or irritation, while if I but touched the tip of its tail with my finger, it would make a vigorous protest by lashing its tail and snapping its jaws. I doubt if even the redoubted snapping-turtle could show signs of a more "rugged" constitution.—*Wm. Frear, University of Lewisburg.*

The First Californian Eel Caught.—The San Francisco *Chronicle* of February 8th, reports the catching by George Bird of the first eel, resulting from the plant of 12,000 made by the California Fish Commissioners. It was caught on the easterly shore of San Francisco bay, and measured three feet in length.—*R. E. C. Stearns.*

Wild Geese as Pests.—In the latter part of January, the farmers of the Upper San Joaquin valley in California, were fighting the wild geese, which in vast numbers were devastating the grain-fields of that region, pulling up the young wheat by the roots.—*R. E. C. Stearns.*

Zoological Notes.—The Proceedings of the National Museum contain notes on a collection of fishes from the west coast of Mexico, by D. S. Jordan and C. H. Gilbert, while Mr. T. H. Bean gives a preliminary catalogue of the fishes of Alaska. Mr. C. H. Boyd records the discovery of the remains of a walrus near Addison Point, Washington county, Me., in a bed of blue clay two feet above high water mark. A few years ago a nearly perfect skeleton was found in the marine clays at Portland, Me.——Excellent zoölogical work is now being done in Japan by students educated in the United States and Europe. In the *Quarterly Journal of Microscopical Science* Mr. Mitsukuri recently published an article on the structure of the gills of Lamellibranchs, and in the January number a paper on the development of the supra-renal bodies in Mammalia. In the *Zoölogischer Anzeiger*, January 9, Mr. Jijima gives an abstract of a memoir on the structure of the ovary, and the origin of the egg and the egg-strings in Nephelis, and Mr. T. Iwakawa gives the results of studies on the genesis of the egg in Triton.——A revision of the Crustaceous family *Idoteidæ*, by E. J. Miers, with full descriptions of the species, is published in the Journal of the Linnean Society, xvi.

ENTOMOLOGY.[1]

POSSIBLE FOOD-PLANTS FOR THE COTTON-WORM. — One of the most interesting characteristics of the Cotton-worm is that it is so strictly confined to cotton as its food-plant. All attempts hitherto made to discover additional food-plants have proved futile; nor have we been able to ever make it feed successfully on other plants allied to Gossypium.[2] We have, however, long felt that there must be some other wild plant or plants upon which the species can exist, and this belief has been all the stronger since it was demonstrated two years ago from observations made by Dr. P. R. Hoy, that the larva may occur in Wisconsin and consequently out of the range of the cotton belt.[3] We have given special directions to those in any way connected with the cotton-worm investigation to search for such additional food-plants, but so far no additional food-plant has been discovered. Last November we received from Dr. J. C. Neal, of Archer, Fla., specimens of a plant with eggs and newly hatched larvæ which he believed to be those of Aletia but which belong to an allied species—the *Anomis erosa* Guen. The plant proved to be one of the Malvaceæ (*Urena lobata* Linn.), which is reported as quite common in that part of Florida and further south, being a tall branching and straggling weed with annual stems and perennial root, from which new shoots arise in January. It blooms from February to December, and is, in addition, a valuable fiber plant, the bark of both stem and root being very strong, and used very generally for whip and cording purposes. The leaves have three very conspicuous saccharine glands on the principal veins toward the leaf stem, and the plant, Dr. Neal reports, is much less sensitive to cold or frost than Gossypium. We find that the plant has been received by Dr. Vasey, botanist of the Department of Agriculture, from several parties in Florida, with inquiries as to the value of the fiber. *Urena lobata* was, until very recently, not known to occur in the United States. It is common on dry hill pastures almost everywhere in the West Indies and southward to Guiana and Brazil, and is also reported from Western Africa, East Indies, China and some of the Pacific islands. It seems to thrive very well in Florida, and is likely to spread to other adjacent States.

The *Anomis erosa*, the eggs and young larvæ of which were not uncommon on the leaves of the Urena, may be distinguished from Aletia by the paler, more translucent character of both egg and larva, and by the first pair of prolegs being quite obsolete, in which character it resembles the *Anomis exacta* that affects cotton in Texas. Aletia larvæ that had been fed on cotton,

[1] This department is edited by PROF. C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

[2] The only partial success in this line is that mentioned in our Bulletin on the Cotton-worm, p. 12.

[3] See Report on Cotton Insects, Department of Agriculture, 1879, p. 89.

when placed upon the Urena refused to feed upon it, and finally perished.

We recently took occasion to carefully examine the Malvaceous plants in the herbarium of the Department of Agriculture with some quite interesting results, although a herbarium is naturally the least favorable place one can choose for an entomological investigation of this character, as plants that are least injured by insects are most apt to be collected, and the mode of preserving the plants still further reduces the chances of finding traces of Aletia, because only one side of the leaf is available for examination. How small this chance is, may be illustrated by the fact that on the specimens of Gossypium in the herbarium, no Aletia eggs or egg-shells could be discovered, and that only one specimen showed any trace of being injured by any insect whatever. Nevertheless a number of eggs or fragments of such—some of them from their structure very closely related to Aletia were found on the following plants:—*Malvastrum spicatum* from Florida and Nicaragua; *Urena ribesia* (which is considered a form of *U. lobata)*, from Southern Florida; *Pavonia typhaleoides* from Cuba; *Sida glomerata* from Cuba.

One object of this examination was to discover, if possible, the particular Malvaceous plant upon which Aletia feeds in the States north of the cotton belt, but this proved to be an almost complete failure, because the herbarium contained only six specimens of such plants from the more northern States, not counting sixteen specimens cultivated in the agricultural grounds at Washington. However, on a specimen of *Sida spinosa* from York county, Penna., an egg was found which has every appearance of that of Aletia.

We would earnestly call upon entomologists who may read these pages to aid us in obtaining evidence of the food-plant of the insect in the more northern States by an examination of the plants indicated by an asterisk in the following list, as it is upon such that the insect will probably be found at some future time, but only late in the season:

LOCALITIES FOR MALVACEOUS PLANTS FROM GRAY'S FLORA.

Althæa officinalis L.—Salt marshes coast of New England and New York. (Nat. from Eu.)

Malva rotundifolia L.—Waysides and cultivated grounds, common. (Nat. from Eu.)

" *sylvestris* L.—Waysides. (Adv. from Eu.)

" *moschata* L.—Has escaped from gardens to wayside. (Adv. from Eu.)

" *alcea* L.—Has escaped from gardens in Chester Co., Penn. (Adv. from Eu.)

Callirrhoë triangulata Gray.—Dry prairies, Wisconsin, Illinois, and southward.

" *alcæoides* Gray.—Barren oak lands, Southern Kentucky and Tenn.

Napæa dioica L.—Limestone valleys, Pennsylvania and southward to the valley of Virginia, west to Ohio and Illinois, rare.

**Malvastrum angustum* Gray.—Rock island in the Mississippi, Ills.

* " *coccineum* Gray.—Abounds on the plains from Iowa and Minnesota westward.

**Sida napæa* Cav.—Rocky river banks, Penna., York Co., Kanawha Co., Va. (Cultivated in old gardens.)

Sida elliottii T. & G.—Sandy soil, Southern Virginia and southward.

* " *spinosa* L.—Waste places, common southward.

Abutilon avicennæ Gærtn.—Waste places, escaped from gardens. (Adv. from India.)

Modiola multifida Mœnch.—Low grounds, Virginia and southward.

Kosteletzkya virginica Presl.—Marshes on the coast, New York to Virginia and southward.

Hibiscus moscheutos L.—Brackish marshes along the coast, sometimes extending up rivers far beyond the influence of salt water (as above Harrisburg, Penna.), also Onondaga lake, N. Y., and westward, usually within the influence of salt springs.

" *grandiflorus* Michx.—Illinois and southward.

" *militaris* Cav.—River banks, Pa., to Ill. and southward.

" *trionum* L.—Escaped from gardens or grounds. (Adv. from Eu.)

" *syriacus* L.— " " " " "

Of these twenty-two species, eight of which are introduced, at least eleven are not likely to occur in Wisconsin, so that the number of plants upon which the insect will probably be found is very limited if, as is most probable, the plant really is one of the Malvaceæ.—*C. V. Riley.*

ARRANGEMENT OF N. A. CYNIPIDÆ BY DR. MAYR.—I published in the March NATURALIST[1] a list of American Cynipidæ as generically arranged by Dr. G. L. Mayr, of Vienna. The list contains less than half of our species, I think, and it does not include all that I sent to him. Several species differ from established genera so far that they will probably form the types of new genera.

I was surprised to find that he recognizes but one American species as belonging to the genus *Cynips*, for this genus contains eighteen European species. His new genera, *Acraspis*, *Loxaulus*, *Holcaspis* and *Belenocnema* are, so far as known, exclusively American. The last named genus is founded on a Floridian species sent him by Mrs. Mary Treat. He describes it, and gives it the name of the discoverer, *B. Treatæ*. *Loxaulus* contains only my *C. q. mammula*, described in the *Canadian Entomologist* last summer. Of the twenty-nine genera recognized by Dr. Mayr, I have mentioned only those containing American species found in his collection. Probably other genera will be found represented here when our fauna shall have been thoroughly worked out. The three Californian and the four Arizonian species which I sent him, fall into European genera, while the seven species included in the four new American genera, are all from the region east of the base of the Rocky mountains.

Andricus palustris O. S. and *Dryophanta polita* B. are placed by Mayr only provisionally in their genera.—*H. F. Bassett, Waterbury, Conn.*

[The list is a valuable addition to the literature of our Cynipidæ. Dr. Mayr has been for some time engaged upon his

[1] The editor does not see page proofs and this list was unfortunately separated from its connections in the March number.

revision of this family, and its appearance has been anxiously awaited. It will, so far as it embraces our species, replace the list given by Baron Osten Sacken, in the *Proceed. Entomolog. Soc. Phila.*, IV. pp. 379–80, published in 1865, since which time, many new species have been discovered, and generic rearrangements necessitated. The list given above numbers fifty-two species, and from the statement made by Mr. Bassett, that "it contains less than half of our species," it appears that a full list of our Cynipidæ will consist of at least a hundred species. Such a list, Mr. Bassett hopes to publish ere long, when he shall have determined the generic position of such species as are not included above.—Ed.]

Mode of Feeding of the Larva of Dytiscus.—Mr. Edward Burgess, in a paper on the mouth in the larva of Dytiscus[1] gives an interesting illustrated account of the mode of taking food through the sickle-like jaws, and shows conclusively that instead of being mouthless, as ordinarily assumed, this larva has a very wide mouth, though the lips are locked together by a dove-tailed groove joint. The food is sucked into an oval opening at tip of the jaws, and drawn along a canal on the inside to a basal outlet which, when the jaws are closed on a victim, is brought into the corner of the mouth, so that the larva sucks up its victim's fluids "as a man inhales the smoke of a pipe stuck in the side of his mouth."

Entomological Notes.—Mr. Wm. H. Edwards argues in the December number of the *Canadian Entomologist*, that *Limenitis arthemis* is single-brooded, and not double-brooded, as Mr. Scudder has maintained.——Dr. J. A. Osborne has recently recorded further experiments proving the occurrence of parthenogenesis in *Gastrophysa raphani*, but believes that it has no place in the economy of the insect analogous to that of bees and wasps, but that it is concomitant of a prevalent species supplied with abundant food of a stimulating character. —— Professor Fernald, in the December number of *Papilio*, gives reason to believe that the Tortricid genus Exartema is equivalent to Eccopsis Zeller, which has priority.——We regret very much to learn that Mr. A. R. Grote has returned from Europe in quite poor health, and hope he may soon recover. While abroad he sold his collection of Noctuidæ to the British Museum at a price variously stated from $3000 to $5000. It is greatly to be regretted that the collection should ever have left this country.——The news of the death of Mr. Jules Putzeys, on January 2d, will be received with regret by coleopterists. Putzeys is well known as the author of several careful monographs of some of the most difficult groups and genera of Carabid beetles. In accordance with the wishes of the deceased, his valuable collection has been donated to the Entomological Society of Belgium.

[1] Proc. Bost. Soc. Nat. Hist. XXI, pp. 223–8.

ANTHROPOLOGY.[1]

THE MAYA-KICHE GODS.—After a few years of cessation from literary labor, Dr. Daniel G. Brinton takes up his polished pen to illuminate the thrilling history of the Maya-Kiche tribes of Central America, in a paper read before the American Philosophical Society, November 4, 1881, and entitled "The names of the Gods in the Kiche Myths, Central America." The communication is published in a separate pamphlet of 37 pages octavo by McCalla & Stavely, of Philadelphia.

The Maya-Kiche stock is divided into sixteen dialects and spoken at present by half a million persons. These people formerly used mnemonic signs approaching an alphabet to record and recall their mythology and history. Fragments of their traditions have been preserved, the most notable being the *Popol-Vuh*, the national legend of the Kiches of Guatemala. This story was translated by Ximenez and by Abbé Brasseur (de Bourbourg), but so imperfectly as to throw suspicion upon the authenticity of the original. As contributing to substantiate the mythical portion, Dr. Brinton has undertaken, in the paper before us, to analyze the proper names of the divinities therein mentioned, assisted by two manuscript vocabularies of the Cakchiquel dialect presented to the library of the American Philosophical Society by the Governor of Guatemala, in 1836, and by original papers from the collection of the late Dr. C. H. Berendt. With much new light thrown upon the labors of his predecessors, Dr. Brinton then takes up the following names of Kiche deities:

Hun-Ahpu-Vuch—The One master of supernatural power, the Opossum.
Hun-Ahpu-Utiu—The One master of supernatural power, the Coyote.
Zaki-Nima-Tziz—The very active White Badger.
Nimak, Nim-tzyiz—Great Hog, White Great Hog (a totemic god).
Tepeu, Tepex, Tepal—The god who had sufficient, the syphilitic god.
Gucumatz—The feather plumed god, the feathered serpent.
Qux cho, Qux palo—Heart of the Lake, Heart of the Sea.
Qux cah, Qux uleu—Heart of the Sky, Heart of the Earth.
Ah-Raxa-Lak, Ah-Raxa-Sel—He of the green dish.
Xpiyacoc, Xmucanè—The paternal and maternal powers of life.
Cakulha Hurakan, Chipi-Cakulha, Raxa-Cakulha } The storm and earthquake gods.
Qabauil—The Divinity.
Chipi-nanauac, Raxa-nanauac—The Spirit of Knowledge, the Genius of Reason.
Voc—The parrot messenger of Hurakan.
Tohil the Just, Avilix and Hacavitz—Tribal gods.
Xbalanque's descent into Zibalba, the underworld, his victory over its inhabitants and triumphal return to the world of light.
The Xbalamob of Yucatan—Very ancient men who guard the towns.
Hun-Batz, Hun-Choven—Patrons of the fine arts.

The paper closes with a short discussion of affinities with Aztec myths and color names.

[1] Edited by Professor OTIS T. MASON, 1305 Q. street, N. W., Washington, D. C.

THE WESTERN RESERVE AND NORTHERN OHIO HISTORICAL SOCIETY.—Tracts 54 and 55 contain the report of the thirteenth annual meeting, and the address of the venerable president, Col. Charles Whittlesey. The address, although seemingly without connection with ethnology, is after all a very interesting piece of work. Indeed, Col. Whittlesey makes the State of Ohio the arena for the drama of five distinct populations: 1. The Symmes purchase, with Cincinnati as a center, settled by the Swedes and Dutch of New Jersey; 2. The Virginia military district, with Chilicothe as its metropolis, settled by Virginians; 3. The Ohio Company, around Marietta, recruited from Massachusetts; 4. The seven ranges of townships next to Pennsylvania, populated from that State; 5. The Western Reserve, about Cleveland, designed to be called New Connecticut, because settled from that State. Alluding to the five most prominent men at the inauguration of the late President (the Shermans, Waite, Hayes and Garfield), the speaker said: "Was it not the result of a long train of agencies which by force of natural selection brought them to the front on that occasion?"

ANTIQUITIES OF ANDERSON TOWNSHIP, HAMILTON COUNTY, OHIO.—The archæologists of the American Association, who visited the Madisonville cemetery last summer, will not soon forget the small, delicate, enthusiastic and modest gentleman who contributed so largely to their happiness. The editor of these notes spent one entire day with him, in company with Mr. C. F. Low, visiting the mounds and earthworks of Anderson township. We suspected at that time something was brewing, and was not surprised to receive a few days ago, "The Prehistoric Monuments of Anderson township, Hamilton county, Ohio," by Charles L. Metz, M.D. [From the Journal of the Cincinnati Society of Natural History, Vol. IV, December, 1881.] The description is a pamphlet of twelve pages, prefaced by a map, in which the Smithsonian symbols are used. For this and for all his self-denying labors, Dr. Metz deserves the unqualified praise of archæologists.

THE ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN.—The August and the November numbers appear in the same binding, and contain the following papers:

1. Foote, J.—Note on Carib chisels.
2. Lewis, A. L.—Notes on two stone circles in Shropshire.
3. Buckland, Miss A. W.—Surgery and superstition in Neolithic times.
4. Wake, C. Staniland—Notes on the origin of the Malagasy.
5. Christison, David—The Gauchos of San Jorge, Central Uruguay.
6. Peal, S. E.—Note on platform dwellings in Assam.
7. Woodthorpe, R. G.—Notes on the wild tribe inhabiting the so-called Naga hills on the north-east frontier of India. Part I.
8. Flower, W. H.—On a collection of monumental heads and artificially deformed crania from the Island of Mallicollo, in the New Hebrides.
9. Wylie, A.—Notes on the Western regions. Translated from the Tsëën Han Shoo, Book 96, Part 2.

10. Flower, W. H.—Report on the bones found in a Roman villa at Morton near Brading, April, 1881.
11. Lewis, A. L.—Remarks on some Archaic structures in Somersetshire and Dorsetshire.
12. Atkinson, G. M.—On a new instrument for determining the facial angle.
13. Gooch, W. D.—The stone age of South Africa.
14. Flower, W. H.—Address to the Department of Anthropology of the British Association, York, Sept. 1, 1881.

1. Mr. Forte's brief note refers to the discovery of an ancient cave workshop for the manufacture of Carib shell chisels.

2. The paper of Miss Buckland is a pleasant review of Dr. Broca's book on Prehistoric trepanning and cranial amulets.

4. In a former communication Mr. Wake had held the Malagasy to be autochthonous. The object of the present writing is to correct this notion and to prove that the origin of this race was from the region inhabited by the Siamese and cognate peoples.

5. The term Gouch-os, so often seen in books on S. America, is not a race name, but implies rather a certain mode of life, and at San Jorge is given to negroes, Brazilians, pure Spaniards, and even to northern Europeans. The paper of Mr. Christison is one of absorbing interest.

6. Mr. Peal essays to connect the pile structures of India with the Swiss lake dwellings.

7. The Naga hills are south-east of Assam, dividing that province from Burma, between 25° and 28° north, and 93° and 97° east. The frequent conflicts of these people with the British army in the east, afforded the officers in Her Majesty's army the opportunity of studying their sociology.

8. By "monumental heads" is meant artificial deformation practiced upon the heads of children at a very early age, by means of circular constriction. Professor Flower takes advantage of a recent collection by Mr. Boyd to bring together the history of this practice in the New Hebrides, a custom not met with in any other islands of the Pacific.

12. The instrument of Mr. Atkinson was invented to measure the angle formed between the ophryo-alveolar line and the plane of the visual axis, so much insisted on by Broca.

13. In a paper extending over sixty pages of the journal, Mr. Gooch, from a large personal experience and by the aid of local colaborers, minutely describes the types, distribution, geological horizon and material of the stone implements of South Africa. American archæologists cannot afford to miss this paper.

14. The only noteworthy utterance for us in Professor Flower's address, is the much-to-be-regretted fact that the Anthropological Institute is far from flourishing.

NECROLOGY.—It is with profound sorrow that we record the death of Professor Carl Engelhardt, late secretary of the Society

of Northern Antiquaries. He was profoundly versed in the antiquities of Scandinavia and Denmark, and was the author of many archæological works. Among them we would mention "Denmark in the early Iron age, illustrated by recent discoveries in the peat mosses of Slesvig-Holstein," a splendid quarto profusely illustrated and dedicated to the Princess of Wales. It was published in London in 1866.

GEOLOGY AND PALÆONTOLOGY.

NEW CHARACTERS OF THE PERISSODACTYLA CONDYLARTHRA.—Besides the characters of this group given in the NATURALIST for December, 1881 (page 1017), there are some further points of importance. The humerus in the two species of *Phenacodus*, where it is known, is much like that of the *Creodonta*, having a supracondylar foramen, and a simple condyle, without intertrochlear ridge. This is the only group of Ungulata where the supracondylar foramen occurs.

Numerous specimens of the species of *Meniscotherium* show that that genus belongs to the *Condylarthra*, and must be referred to a new family characterized by its more complex molar teeth. It is also possible that the number of the digits is different. The astragalus and humerus have the characters of those of *Phenacodus*, that is of the *Creodonta*. The two families of Condylarthra will be contrasted as follows:

Phenacodontidæ, Dentition tubercular. *Meniscotheriidæ*, Dentition lophodont, with external and internal crescents and deep valleys.—*E. D. Cope.*

MESONYX AND OXYÆNA.—In *Mesonyx ossifragus* the anterior limbs are much shorter than the posterior ones. This is especially marked in the humerus, which resembles in its form that of the otter. The ulna has a wide deep groove on its superior face, whose elevated external bounding ridge indicates a powerful extensor of the pollex, and supinator muscles. But the supination of the hand was impossible since the head of the radius is transverse and firmly fixed to the ulna. The greater length of the posterior limbs would indicate that the animal frequently rested on those extremities alone, in a position intermediate between those used by the bears and kangaroos. The species is as large as a bear, and has a very large head.

In *Oxyæna* the posterior foot has some characters like those of the seals. The cuboid bone is exactly like that of those animals, and it is evident that the external toes of the hind foot diverged extensively and were probably constructed for swimming.—*E. D. Cope.*

THE RHACHITOMOUS STEGOCEPHALI.—The segmented vertebræ characteristic of this order have been found in the genera *Eryops*, *Zatrachys* and *Trimerorhachis* in America, and *Actinodon* in

Europe. It was first pointed out by myself in *Eryops (Rhachitomus)* and *Trimerorhachis*, in the NATURALIST, May and Sept., 1878 (p. 633), and soon after by Gaudry in *Actinodon*. An examination of the figures and descriptions given by Von Meyer (Palæontographica) of the rather imperfect specimens of *Archegosaurus*, led me to believe that the vertebræ of that genus possess the segmented character also. I therefore included *Archegosaurus* in the same natural division with *Eryops*, etc., and employed for it the name *Ganocephala* which had been created by Owen for its reception.[1] It now appears from the descriptions of Dr. Fritsch that the vertebræ of *Archegosaurus* are not of the segmented type, but that they are discoidal, as in the *Labyrinthodontia*. Under these circumstances, the suborder *Ganocephala* must be given up, and a new name given to the suborder represented by *Eryops*, *Actinodon*, etc., and which I characterized in the Proceedings of the American Philosophical Society, for June, 1880. This suborder may be called the *Rachitomi*, and will include the following genera. *Trimerorhachis ; ? Parioxys ; Eryops ; Actinodon ; Zatrachys ; ? Pantylus.* There are two families, defined as follows :

Occipital condyle concave, undivided.....*Trimerorhachidæ*
Occipital condyle divided into two lateral condyles.....*Eryopidæ*

But one genus can yet be referred to the first family; to the second belong *Actinodon* and probably *Zatrachys*, besides *Eryops*.—*E. D. Cope.*

MARSH ON THE DINOSAURIA.—Professor Marsh has published a more complete systematic arrangement of these reptiles than the one noticed in the March NATURALIST. In this he includes many of the genera described by European and American authors, and gives them their appropriate positions. Genera whose characters cannot be ascertained are omitted, and some synonymes are included.

GEOLOGICAL NEWS.—The Geology of Frenchman's bay, Maine, is treated of by W. O. Crosby in the Proc. Bost. Soc. Nat. Hist. The rocks consist of a schistose silver-bearing group, and a slate of Cambrian or Primordial age. A few fossils have been found in the same slate at other localities.——M. Daubree (Bull. Soc. Geol. de France) gives details of the two directions taken by joints or fractures in the cretaceous strata near Paris. These joints are usually parallel to the reliefs of the region, and the two systems are nearly at right angles to each other.——The *Geological Magazine* for December, 1881, contains descriptions of some fossil Crustacea from the Stonesfield slate of Oxfordshire, England, by Hy. Woodward. Three species of *Eryon* and one of the curious larval-looking genus *Palæocaris*, hitherto known only from the *P. typus* of Meek and Worthen, are for the first time published.——The same magazine includes articles on the Brid-

[1] Proceeds. Amer. Philosoph. Soc., 1880, June.

lington and Dimlington (East Yorkshire) shell-beds, by G. W. Lamplugh; and on the "Parallelism of the Hanoverian and English Upper Jurassic," by C. Struckmann, translated by W. S. Dallas. One hundred and twenty-five fossil species are common to this formation in the two countries, nearly half of them bivalves. The North German Upper Jura is poor in Cephalopoda, and the small number of corals known to be common is most probably owing to the fact that the German corals are not yet worked out monographically.——A late issue of the Annales des Sci. Geologiques contains a malacological history of the Hill of Sansan, department of Gers, one of the richest deposits of fossils in France. The article includes a notice of the geology, with colored sections, and a dissertation upon the climate and topography of the region at the epoch of the deposit.——In the *Geological Magazine*, January, 1882, E. T. Newton, F. G. S., has some notes on the Birds, Reptiles and Amphibia of the Preglacial Forest Bed series of the East of England. Most of the birds are indeterminable, but the genera *Anser*, and, doubtfully, *Anas*, are identified. Reptiles and amphibia have never previously been noted from those beds.—— In the same number H. H. Howorth, F. S. A., writes of the "Traces of a Great Post-glacial Flood," as shown by the loess, the shells of which are land shells, while the relics of man and animal remains tell the same tale.——A. G. Nathrost (Kongl. Svenska Vetenskaps-Akad. Hand.) shows that it is not improbable that many markings referred to algæ are really trails of animals. He especially refers *Eophyton* to the trails of Medusæ.—— In the Reports, British Association, Section C. York Meeting, J. Prestwich argues against the generally accepted theory of volcanic action, the first cause of which he believes to be the welling up of the lava in consequence of pressure due to slight contraction of a portion of the earth's crust; this lava vaporizes the waters in the crevices of the volcano as well as those that afterwards flow into the cavities, and thus explosions are produced.——The last issue of the *American Journal of Science* contains an article by J. D. Dana, upon the "Flood of the Connecticut River valley from the melting of the Quarternary Glacier." The author refers the "kames" in the Connecticut valley, and terrace formations in general, to conditions at variance with those of Mr. Upham.——In the same journal Mr. A. O. Derby shows that, under the name of itacolumite, two very distinct geological series have been confounded, the newer of which is almost exclusively quartzite, but in places contains pebbles of all the rocks of the older series, including the diamond. Diamonds have also been taken from clay *(barro)*. The original diamond formation of Brazil is stated to be probably Cambrian.——The International Geological Congress of Bologna decided during the session of one week in September last that a chart of Europe should be published at Berlin on a scale of 1 : 1,500,000. The terms employed are to be Group for the highest

divison, System for the next, Series for the third, Stage for the fourth, for the fifth Assize or Couche. Formation was not adopted because it has other meanings.——M. St. Meunier has succeeded in artificially forming enstatite, a mineral which is common in meteorites, and in a section shows fan-shaped or star-shaped forms. It is out of those forms, producible (as M. St. Meunier remarks) in a porcelain tube heated to redness, that the fancy of Mr. Otto Hahn constructed the crinoids and sponges which form the subject of his work.——At a recent meeting of the New York Acad. of Sciences, Dr. Alexis A. Julien read an able paper upon the volcanic tuffs of Idaho and other western localities.

MINERALOGY.[1]

HELVITE FROM AMELIA COUNTY, VIRGINIA.—Among some minerals recently obtained from the mica mine near Amelia Courthouse, Virginia, already famous for its microlite, was a yellow, crystalline substance which upon examination has proved to be *Helvite*. The mineral occurs in crystals and friable crystalline masses imbedded in bluish-white orthoclase, and is generally associated with pale red topazolite. While no crystals were found sufficiently perfect to allow of measurement, the absence of any action upon polarized light proved their isometric character.

The mineral has a hardness of about 6, a specific gravity of 4.306 (Haines), a sulphur-yellow color, a somewhat resinous lustre, and is partially translucent. It fuses at about 4 with intumescence to a brown glass, gives no water in the closed tube, and with the fluxes gives the reactions for manganese. Fused on charcoal with soda, it gives a hepar. It is soluble in hydrochloric acid, evolving sulphuretted hydrogen and leaving a residue of gelatinous silica.

My friend, Mr. Reuben Haines, has been kind enough to contribute the following analysis:

Gangue (SiO_2 insoluble in $NaCO_3$)	9.22
SiO_2	23.10
BeO	11.47
MnO	45.38
Fe_2O_3	2.05
Al_2O_3	2.68
CaO	.64
K_2O	.39
Na_2O	.92
S	4.50
	100.35

The mineral was dissolved in HCl, and the "gangue" found by repeatedly washing the total SiO_2 on the filter with a hot concentrated solution of $NaCO_3$, which removed all the soluble SiO_2. By

[1] Edited by Professor HENRY CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

regarding the sulphur as combined with the iron and part of the manganese, the total percentage would be reduced by 2.25 per cent.

Helvite has not previously been found in America.—*H. Carvill Lewis.*

A NEW MANGANESE MINERAL.—Mr. M. W. Iles has examined an efflorescence which occurs upon an ore vein in Park county, Colorado. The efflorescence is of a pure white color, is very soft, has a specific gravity of 2.16, and occurs in friable crystalline masses. It is soluble in water, and has a bitter, astringent taste. The aqueous solution has an acid reaction, indicating an admixture of free sulphuric acid. The following mean composition was obtained:

FeO	ZnO	MnO	SO_3	HO.
4.18	5.97	22.31	36.07	31.60

The mineral appears to be a hydrous sulphate of manganese, containing perhaps admixtures of sulphatite, melanterite and goslarite. It should have further examination.

GALENA WITH OCTAHEDRAL CLEAVAGE.—About twenty years ago, Dr. John Torrey noticed at the Pequea mine, Lancaster county, Penna., a remarkable variety of galena, which had an eminent octahedral cleavage. The usual cubical cleavage was very indistinct, but was made more prominent after heating. He supposed the galena either to be pseudomorphous after fluorite or to be a dimorphous variety. Dr. Cooke, however, showed that by pressure, traces of an octahedral cleavage may be developed in galena from many localities, and Dr. Genth holds that such cleavage may be a natural result of octahedral crystallization.

A few months ago a similar variety of galena was found near Mont Blanc, Switzerland. A large crystal formed of two cubo-octahedrons united by an octahedral face was found to give perfect and brilliant octahedral cleavage faces when struck by a hammer. The cleavage faces had a slightly undulating surface. The specific gravity of the crystal was 7.67. No alteration in cleavage was produced by heating.

THE CONDITION OF SULPHUR IN COAL.—Dr. W. Wallace[1] has made some analyses of coal, which lead him to the conclusion that the sulphur found in coal, usually regarded as due to pyrite, exists frequently as an organic compound. He finds the amount of sulphur in many coals to be greatly in excess of the amount necessary to form bisulphide with the iron which is present.

At the recent meeting of the Amer. Inst. of Mining Engineers, Dr. Thos. M. Drown, probably not aware of these researches, contributed an interesting series of analyses of coals, which lead to

[1] Proc. Phil. Soc. Glasgow, 1879–80, p. 223.

the same conclusion. He shows, moreover, that the "organic sulphur" in coal is not affected by the process of coking.

SPIRAL FIGURES IN CRYSTALS.—Students in optical mineralogy will be interested in an article by L. Wright, in a recent number of the *Philosophical Magazine*, entitled "Some Spiral Figures observable in Crystals, illustrating the relation of their Optic Axes." The author places a section of the mineral to be examined between a quarter-wave plate and a thick plate of quartz and examines this arrangement in a polariscope with converging rays. Beautiful spiral figures are produced, resembling the well known "Airy's spirals." A uniaxial crystal, as calcite, shows a system of double spirals, mutually enwrapping each other (Fig. 1.). A single axis of a biaxial crystal shows a simple spiral (Fig. 2), while if the section includes both axes of the biaxial crystal, as muscovite, two series of single spirals are observed, which, while separated from each other, finally enwrap one another (Fig. 3).

FIG. 1. FIG. 2. FIG. 3.

This a beautiful demonstration of the well known fact that the optic axis of a uniaxial crystal has a two-fold character. Fig. 1, representing a uniaxial crystal is seen to be composed of the same two spirals seen in Fig. 3, a biaxial crystal. A uniaxial crystal must therefore be regarded as a case in which the two axes of a biaxial crystal coincide.

Mineralogists will here perceive how slight a distinction exists between a uniaxial crystal and a biaxial crystal of small optic axial angle and will understand how, for example, a biotite having often no appreciable biaxial character may yet be regarded as monoclinic with an optic axial angle of nearly 0°.

NATIVE SILVER.—Several interesting occurrences of native silver have recently been described.

The first of these is in the province of Almeria, Spain, where it has been found in iron ore. A bed of hematite of considerable

thickness forms a hill, at the base of which is a deposit of miocene marl containing occasional beds of argentiferous galena. The galena has long been worked for silver, and it is said that the Phœnicians and Romans once mined in that locality. Recently native silver has been found in the hematite itself, and in a bed of flint which overlies it. Veins of barite which traverse the hematite bed are also rich in native silver. The silver is said to occur in rounded grains.

Another interesting occurrence of silver has been described by Kœnig and Stockder. They found it at a Colorado locality as clusters of crystals surrounded by or implanted in coal. The association of native silver with coal is a good demonstration of the accepted theory that organic substances play an important role in the reduction of metals from their salts.

According to a note in a recent number of the *Engineering and Mining Journal*, native silver has been discovered in small specks and scales at the copper mines near Somerville, N. J.

SOME VIRGINIA MINERALS.—The students in the laboratory of the University of Virginia, have contributed to the *Chemical News* several valuable notes upon Virginia minerals.

S. Porcher describes a native alloy of gold and silver occurring in rounded grains in Montgomery county. The grains have the color of gold on the exterior, but are almost white within. The specific gravity is 15.46, less than that of gold. Allowing for the partial removal of silver from the surface, the composition is shown to be represented by single atoms of gold and silver, AgAu.

T. P. Lippit has analyzed an epidote of clear pistachio green color, and finds that the iron is all in the ferric condition and that the mineral is about two-thirds aluminium epidote and one-third iron epidote.

B. E. Sloan has examined the beautiful bluish-white felspar which accompanies the microlite, columbite and beryl of Amelia county. This felspar resembles oligoclase, but is now shown to be a true orthoclase.

B. H. Heyward describes a zinc-bearing clay from Pulaski county; and A. L. Baker found that iodine was present in the salt brines of West Virginia.

NEW MINERALS.—*Nocerine* is a double fluoride of magnesium and calcium, which occurs in white acicular crystals in the volcanic rocks of Nocera.

Neocyanite is an anhydrous silicate of copper, which occurs in small deep blue crystals upon the lava of Vesuvius.

Tritochorite is a vanadate of lead and zinc, of a dark brown color and yellow streak, occurring in columnar cleavable masses.

Melanotekite is another massive, cleavable mineral of dark color. It is a silicate of lead and iron, occurring at Longban, Sweden. It has a metallic lustre, and is nearly as hard as quartz.

MINERALOGICAL NOTES.—A "crystalline bitumen" is found in trap at Port-a-Port bay, Newfoundland. It seems to have resulted from the heating action of the igneous dyke upon bituminous shales and limestones. These latter yield petroleum.——Artificial pseudomorphs of calcite after gypsum have been made by placing a crystal of gypsum in a cold, saturated solution of carbonate of ammonia. The change takes place gradually, and requires several days unless the gypsum is in fine powder, when a few hours suffice.——The beautiful amianthus from Canada is found to be much finer than any asbestos for the manufacture of asbestos fabrics. It is said that the fabrics made from it are light, soft, and white. It is also felted into sheets, which are flexible, and unctuous to the touch. It is known in commerce as "Bostonite" or "Canadian fiber."——An examination of a white slime which covered the bottom of a mine in Westphalia showed that it was composed of a mixture of Aluminite, Allophane and Hydrargyllite.——A recent analysis of the water of the Dead sea showed it to have a spec. grav. of 1.186, and to contain the following number of grams of solid matter in one litre:

KCl	$NaCl$	$NaBr$	$MgCl_2$	$CaCl_2$	$CaSO_4$
16.90	74.05	5.02	128.10	35.36	1.21

——Gold is reported as having been found in a ledge of quartzite near Amity, Orange county, New York. This is a locality already well known to mineralogists as having afforded many rare and beautiful species.——In a specimen of Cerussite from Leadville, Col., analyzed by M. W. Iles, a small percentage of Massicot and a trace of chlorine was detected.

Mineralogists should beware of artificial moss-agates. They are being manufactured of great perfection at Oberstein, Germany. The coloring matter is introduced in chalcedony to form artificial dendrites.

GEOGRAPHY AND TRAVELS.[1]

EXPLORATIONS IN EQUATORIAL AFRICA.—*Makua Land and the Interior of Mozambique.*—Makua Land, the unexplored region lying between Masasi and Mozambique and south of the Rovuma river has recently been traversed in different directions by three Englishmen. The Rev. Chauncy Maples, of the Universities Mission, advanced as far as Meto, about S. lat. 13°25′ E. long. 37° 58′. He was prevented by the cowardice of his native followers from continuing his journey to Mozambique. He heard reports of the existence of a snow-capped mountain called Irati, about 130 miles south-south-east of Meto and visible from that point in very clear weather.

Mr. H. E. O'Neill, British Consul at Mozambique, has recently undertaken the exploration of a route to Lake Nyassa which starts from Kisanga, opposite the island of Ibo. He found the country

[1] Edited by ELLIS H. YARNALL, Philadelphia.

for the first forty miles of his march from the coast at Mokambo Bay thinly timbered with thick undergrowth, including quantities of the India-rubber vine, fairly cultivated and populous. The country then becomes rocky and broken with hills and peaks of bold shapes and precipitous sides from 200 to 1000 feet in height. At the one hundred and forty-second mile of his march he speaks of coming into view of the exceedingly beautiful Shalawe plain, which, dotted with villages, stretches away for many miles to the west and south where the vista terminates in a range of splendid hills 2000 to 4000 feet high. Mr. O'Neill made a successful journey of 600 miles, returning at the end of November last, and we hope shortly to give some details of his explorations.

Mr. Joseph Thomson, who was sent by the Sultan of Zanzibar to examine some so-called coal beds on the Lujende river near its junction with the Rovuma, passed through the northern portion of this region and has sent an interesting account of his journey to the Royal Geographical Society. The "coal" turned out to be some irregular layers of bituminous shale of no practical use. Mr. Thomson's report so much displeased the Sultan that he at once broke the engagement he had made for a period of two years with Mr. Thomson, who has returned to England.

One of the members of the Universities Mission, the Rev. W. P. Johnson has also recently visited a lake; the source of the Lujende branch of the Rovuma. On reaching the banks of the lake he could see it stretching away to the south-east, the lofty hill Mangoche, near Nyassa, east of Mponda, being visible at the same time to the north-west. He supposes the lake to be the Lake Shirwa of Livingstone, the northern part of which has never before been visited.

Mr. Schuver's Expedition to Central Africa.—Petermann's Mittheilungen has received an account of the progress of Mr. J. M. Schuver on his journey from the Nile to Central Africa. He reached Fadassi on June 12, 1881. The source of the Termat affluent of the Blue Nile is in the Sori mountains west of Fasuder. Another stream of the same name near Belletafa is an affluent of the Jaboos river. He left Fadassi, on July 30th, on a trip of thirty-eight days to the south, during which he reached the country of the Légha Gallas near the source of the Jaboos. He also explored the Amam country which is watered by two affluents of the Jaboos. The water-shed between the two Niles was defined as far as the eighth parallel. He saw far away to the south-west the great lake and river Baro flowing towards the west and situated a degree further south than as shown on Petermann's map. The Wallel mountain rises to the east to the height of 11,000 feet.

The Légha Gallas are a powerful tribe numbering 20,000 warriors, and inhabit a country far to the westward of the Galla country proper. Mr. Schuver proposed to leave Fadassi on January 1st, to explore the unknown regions down to the equator.

Dr. Stecker in Abyssinia.—Dr. Stecker, the former companion of Dr. G. Rohlfs, has recently visited Lake Tana. He has explored all the lake, visited the mountains on its shores, and prepared a detailed map of this basin. Lake Tana has a superficial area of 1150 square miles, and is at an elevation of 6370 feet above the sea-level. The greatest depth ascertained is 38 fathoms. Dr. Stecker has made interesting collections of plants, insects, fishes and mollusks, and he discovered in the Gorgora mountains, situated north of the lake, unmistakable proofs of volcanic activity; eruptive cones, a crater and a mighty lava stream, all probably recent, as in the volcanic rocks he has found inclosed remains of a mollusk which still inhabits the waters of Lake Tana. Dr. Stecker, since he completed the survey of the lake in July last, visited Zobul, a province only recently conquered by King Johannes, and never before visited by an European explorer. It lies to the east of Lake Ashangi and is inhabited by Azebu Galla. Dr. Stecker's last letter is written from that lake, the environs of which he had surveyed. If all goes well, he proposes to explore the countries to the west of Lake Tana as far as Fazokl, and then to visit Enarea and Kaffa.

De Brazza on the Congo.—M. Savorgnan de Brazza, when last heard from, had arrived on the Alima river and was then preparing to launch his small steamer to begin the exploration of the Congo. M. Mizon, who was sent out to assist him reached Franceville, the station on the Upper Ogowé, on September 22, 1881. In his report to the French Committee of the International African Association he mentions among the products of the Upper Ogowé country caoutchouc and palm oil. There are forests of wild pine, the fiber of which is used by the natives for various purposes, including nets for catching game and fish.

Pögge and Wissmann.—Doctor Pögge and Lieut. Wissmann, owing to the disturbed condition of the country, have decided not to attempt a visit to Mossumba, the residence of the Muata Yanvo, but will endeavor to reach Tushilango-land. To do this they must follow the Kassai river to its junction with the Lulua, near to which they expect to find a great lake. They will thus advance, if successful, into an entirely unexplored portion of the Congo basin near the fifth degree of south latitude and several hundred miles north of Schütts's furthest point.

Doctor Buchner.—The German traveler, Dr. Buchner, in an address made at St. Paulo de Loanda on his return from the interior of Africa, after giving a brief account of his journey to, and residence at Mossumba, the capital of the Muata Yanvo, stated that in his endeavors to push northwards after leaving Mossumba, he had crossed fifteen rivers, thirteen of them in canoes. With the exception of two, all these rivers have parallel and northerly courses. In this respect Dr. Buchner fully agrees with the views of his predecessor, Herr Schütts, as to the Kassai water

system, but he does not think that, even after it has received all its tributaries, the Kassai can be in any way compared with the Lualaba. Where he passed it the last time, in 8° S. lat. in the dry season, the Kassai had only a breadth of 394 feet, and a depth of ten feet, with a current of rather less than two miles.

Notes.—A relief map of the equatorial region of Africa on the horizontal scale of one inch to twenty-five miles, and the vertical scale of one inch to five thousand feet has recently been exhibited in London.——The French Government has undertaken to make a railroad between the Upper Senegal and the Niger rivers. The surveying expeditions reached the starting point of the road on the Senegal at Khay, seven or eight miles below Medina on November 6th last.——Commander V. L. Cameron, sailed from Liverpool on December 31, 1881, for Axim to join Capt. R. F. Burton in his exploration of the country at the back of the western portion of the Gold Coast colony.——A Russian expedition for the exploration of Western Equatorial Africa is to leave Europe in April. The Cameroons mountains are proposed as the base of operations, and the exploration of the reported lake region to the east of them is the chief aim of the expedition.—— Dr. Josef Chavanne estimates the mean altitude of the continent of Africa to be 2169.93 feet or double the mean altitude of the continent of Europe, which is estimated at 971.41 feet.——Since the return of the three native envoys from England, King Mtesa has been much better disposed to the English missionaries in Uganda.

MICROSCOPY.[1]

American Society of Microscopists.—The Proceedings of the fourth annual meeting of this Society, held at Columbus, Ohio, August 9th to 11th, 1881, have been issued in a pamphlet of 102 pages and seven plates. Perhaps the most generally interesting of the ten papers published, is "A Study of Blood," by Lester Curtis, M.D., of Chicago. This paper describes a very careful study, with one-tenth and one-sixteenth objectives, of fine definition and high resolving power, of pus corpuscles, and of white corpuscles, and bleached red corpuscles of human blood, with a view to determining the reality or otherwise, of the net work of fine fibers described as occurring in such structures, by Dr. Carl Heitzmann, of New York, in 1873, and subsequently by Dr. Louis Elsberg, of the same city, Dr. Klein, of London, in his Atlas of Histology, and other writers. Although Dr. Curtis easily recognized (what, indeed, it is not difficult to see) a more or less distinct appearance resembling a net-work, when the field was somewhat blurred and the outlines of objects indistinct, he uniformly by such change of adjustment as would secure a fine definition and distinct outlines, found the appearance of net-work replaced

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

by a quite distinct view of the surface of the corpuscle covered with small nodules of unequal size and placed at irregular intervals, clearly defined, and capable of casting shadows in various directions. No net-work could be seen between or below these nodules, though in some cases their shadows might seem to resemble one. Aside from the opinion of so competent a judge of appearance as Dr. Curtis, it may be added that the appearance of nodules in the absence of a net-work, as figured in the drawings representing his observations, indicates clearness of definition and reality of structure as distinguished from optical illusion. The only real question is whether a net-work of fibers, on another plane underlying this could have escaped detection by the same means which rendered the nodules so distinct. While the author's experience may not be considered absolutely conclusive in so difficult a question, contested by so competent authority, still it is a valuable and interesting contribution to the subject, and it is quite sufficient to teach caution in adopting a theory which may yet be discarded along with the hexagonal markings of *Pleurosigma angulatum*.

An interesting paper by C. M. Vorce, of Cleveland, on "Forms observed in water of Lake Erie," discusses the various vegetable and animal organisms obtained by filtration, through a muslin bag tied over a faucet, from the water supply of the city of Cleveland. Besides casual observations made at other times, regular weekly examinations were made for a year or more. Nearly 200 forms are figured upon a folded plate. The following general conclusions are of special interest: "Surprising to the writer was the discovery that the winter season was the most prolific of the whole year in number and variety of forms observed. * * * The most noticeable peculiarity of the filterings taken at this season is the abundance of infusoria, rotatoria and crustacea, which in small bodies of water are warm-weather forms; and next in attracting attention is the remarkable activity of reproduction in vegetable life. Indeed, it is soon apparent to the observer that while the advent of wintry frosts almost suspends the course of growth and reproduction in most allied forms in small and shallow waters, in these vast watery worlds the course of life with these minute organisms goes unceasingly on without a rest, and with, indeed, no perceptible check or stay. When the change in volume is imperceptible, and the change in average temperature but a few degrees, there is for the forms in these great waters little or no need for nature to resort to 'winter eggs' and 'resting spores,' although they are sometimes found, more, probably, from organic idiosyncracy than from climatic or local causes, such as chiefly contribute to cause such life changes in usual circumstances. In the lake waters the advent of spring exhibits no other effect upon the organisms we are considering than to cause an acceleration of the processes of multiplication and reproduc-

tion in many of the forms, so that these accelerated forms eventually become so much more numerous than the others that the latter are frequently looked upon as missing, although usually to be found if carefully searched for. In addition to this cause, the same effect is increased as spring advances and summer approaches, by the shallow water forms being swept in from the streams and continuing their reproduction in the lake waters. And in the cases where examinations are made from water supplies passing through storage reservoirs, the influence of the still water in the reservoir, and of its bottom of sluicy mud, is also to be considered. As summer wanes and cold weather again approaches, the winter forms increase in activity and abundance, while summer forms become more inactive, and the preponderance is again reversed."

Under the caption of "A Tumor of the left auricle," D. N. Kinsman, M. D., of Columbus, gives an excellent clinical report of a rare and interesting medical case. Though chiefly valuable to physicians, the microscopical portion is sufficiently prominent to justify its appearance in the proceedings.

The nature of "muscular contractility" is treated at length by Jacob Redding, M. D., of Falmouth, Ind. The author's theory seems to rest partly upon plausible but not altogether safe reasoning as to what would be likely to be found; his description of the tissues studied is not likely to be fully accepted by histologists, who will approve still less his free statements as to the superficial view of former authors, and of their having completely ignored, or, at least, remained silent upon the subject of the interior of the muscular "cells." The article will repay a careful study. It is illustrated with a diagrammatic plate, which delineates with great distinctness the author's theory.

Shorter articles occur upon the "Innervation of the lungs," by A. M. Bleile, M. D.; "Gregarina in the American lobster," by Professor A. H. Tuttle, and "Destruction of Acari by a fungus," by C. M. Vorce. Also, a review of different kinds of "Binocular microscopes," by George E. Fell; an argument in favor of making "Homogeneous-immersion objectives adjustable," by George E. Blockhan, M. D., and a description, by E. L. Shurley, M. D., of "An improved slide for the examination of gaseous matter." This is a glass slide with an attached cell and cover-glass, the center of the bottom of the cell being raised by a glass disk, so that the bottom of the cell will be within reach of the focal capacity of the objective used. The gas is introduced through an opening in the side of the cell by means of a fine metallic canula and a small flexible rubber tube, supplied from a compressible rubber bag or globe, such for instance, as in the instruments used in medical practice for the insufflation of powders, or in the chemical laboratory for operating wash-bottles and other apparatus. The method is capable of further usefulness in microscopy.

BAUSCH'S HOMOGENEOUS IMMERSION OBJECTIVES.—The Bausch & Lomb Optical Company, Rochester, which, under the able supervision of Mr. Edward Bausch, is making remarkable progress in the construction of lenses, has added to its list a series of homogeneous immersion objectives, from $\frac{1}{4}$th to $\frac{1}{25}$th inch, claiming an angular aperture of 140° in medium equivalent to crown glass. They are made adjustable, and up to $\frac{1}{12}$th inch cost from $70 to $100. By a change of adjustment they are capable of use as water or glycerine immersion. An immersion illuminator of ingenious construction is made for use with them. New $\frac{1}{4}$th, dry, of 140° is also made, with long working focus, and so well corrected that it will resolve No. 18 or No. 19 of Möller's test-plate in balsam.

LEHIGH VALLEY MICROSCOPICAL SOCIETY.—This new society held its February meeting in Easton, with a good attendance. Dr. Isaac Ott described and illustrated Dr. Stohrer's (of Leipsic) plan for registering the growth of plants, and confirmed that author's hypothesis that during the day plants do not grow as rapidly as at night. Mr. F. Wolle exhibited specimens of filamentous alga, illustrating a growth in some instances of from one-half to three-quarters of an inch per hour. Mr. E. A. Rau also exhibited botanical specimens illustrating the growth of the lower orders. Other objects were shown by E. P. Seip and Breinig, and Mr. G. W. Stout.

PIGEON-POST FILMS.—Having obtained a supply of the gelatine films used for transmission of news by pigeon-post during the siege of Paris (the expedient of posting despatches in the form of microscopic photographs, by the way, having been suggested by Sir David Brewster nearly fifty years ago), the editor of this department of the NATURALIST will take pleasure in sending an unmounted specimen, sufficient for a microscopic object, to any person sending him a stamped and directed envelope for that purpose. Return exchange optional.

BLOOD STAINS ON STEEL.—Dr. M. C. White, of New Haven, has been able to recognize and measure, by means of the vertical illuminator and a eighth objective, blood-corpuscles upon a steel instrument that had been exposed during two winters in the woods.

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SCIENTIFIC NEWS.

— The annual report of the Boston Society of Natural History for 1881, while recording progress in the arrangement of the museum and the issue of its publications, shows the amount of general interest felt by the citizens at large in the popular work of the society in the diffusion of science. Two ladies have generously paid the entire expenses of the Teachers' School of Science estab-

lished by the society, lectures having been delivered by Professors Cross, Hyatt, Goodale and Mr. W. O. Crosby. The average attendance on these lectures was at first 400. As the result of these lectures Mr. Augustus Lowell recently sent word that the society would receive an annual donation of $1500, to be expended in the Teachers' School of Science. The laboratory of the society has been used the past year by a Saturday morning class for teachers in zoölogy, a class in zoölogy for the Boston University, a class in zoölogy and palæontology from the Massachusetts Institute of Technology, a special class in biology, and also in physiology, under the exclusive control of Mr. Van Vleck. Other donations for educational purposes under the auspices of the society are recorded.

— The reports of the Tenth Census are concerned much more with the material resources of the country, and has invited the coöperation of expert scientists to a far greater extent than heretofore. This is good evidence that scientific ideas have as never before impressed themselves upon the people and government. This will lead to a truer economy and a wiser administration of all subjects relating to the natural resources of the country. Besides the admirable report on the fur seal, which is noticed elsewhere, we have received an elaborate report on the Oyster Industry, prepared by Mr. Ernest Ingersoll, under the direction of the Commissioner of Fish and Fisheries. It consists of 250 quarto pages, with suitable illustrations. The account of the mode in which the starfish feeds upon the oyster is in some respects new to us. The excellent researches of Dr. Brooks upon the embryology of the oyster are given in full with his original drawings, and this illustrates how often what at first sight appears to be abstruse science and most remote from any practical issue, becomes available and necessary in such a practical matter as the oyster fishery.

— The eminent physiologist and anatomist, Professor Theodor Schwann, who in 1839 published his famous "cell theory," which made such a revolution in biology, and has done so much to simplify our conceptions of the general structures of organized bodies, died at Liége in February. Although active as a teacher, in late years Professor Schwann did not publish much, but he held to biology very much the same position maintained by Faraday in physics. He was born in 1810, was an assistant of J. Müller, the great anatomist, and afterwards was appointed to a professorship in the University of Liége, which he held until the time of his death. In 1848, on the fortieth anniversary of Schwann's professoriate, deputations from all the important universities in the world went to Liége and presented addresses, while all distinguished biologists contributed their cartes to an album which was presented to the Professor.

— The report of P. W. Norris, superintendent of the Yellowstone National Park, describes the recent violent eruptions of a geyser which he calls the "Excelsior." During much of the summer of 1881 this geyser sent up to a height of from 100 to 300 feet, sufficient water to render the rapid Fire Hole river, nearly 100 yards wide, a foaming torrent of steaming hot water, and hurled rocks of from one to one hundred pounds' weight around the edges of the crater. When the geyser is not in motion the column of steam rising from the crater forms a conspicuous landmark in the park. A new map of the park accompanies the report.

— At the last meeting of the Quekett Microscopical Club, Mr. F. Enock explained a new method of protecting cells from damage by external pressure upon the cement, his device consisting of a small metallic ring of angular section, which at the same time fitted closely round the cell and overlapped the margin of the cover-glass. It was believed that when placed in position and properly cemented round it would effectually prevent the escape of glycerine.

— Professor DuBois Raymond, in a recent address before the surgeons of the French army, adopts the dynamic theory of heredity originally proposed by Cope in 1871, and subsequently elaborated by Haeckel under the name of perigenesis. He does not credit either of these naturalists.

— The milk of the elephant, according to Dr. Charles Doremus (America), is the richest that he has ever examined, containing less water and more butter and sugar than any other. It has a very agreeable taste and odor.

— Dr. William A. Hammond has recently read a paper on the mental constitution of Guiteau, in which he takes the ground advocated by the NATURALIST in its August, 1881, number.

— The Naturalist Brazilian Exploring Expedition, under Mr. Herbert Smith, left Rio for the interior, Jan. 1, 1882.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

CALIFORNIA ACADEMY OF SCIENCES. Dec. 5.—At this meeting Professor Davidson again presided after an absence of several months in the field in connection with the work of the U. S. Coast Survey. There was a large attendance. Among the donations to the museum was one from E. F. Gerald of a fine specimen of vanadinite, the first discovered in the Pacific States or Territories. It was found forty-five miles above Yuma. Dr. W. F. McAllister presented an aboriginal skull, taken many feet below the surface at Mount Goat, Tombstone District. Captain C. L. Hooper of the *Corwin* donated two specimens of Emperor

geese and a moosehead, with horns attached, from the Yukon river, in Alaska. John G. Lemmon described a new species of gentian, which he discovered in September last on the summit of the Chiricahua mountains, in Southeastern Arizona, and which on account of its small flower-cups, he named *Gentiana microcalyx*. It was a valuable acquisition to the cultivated flora, besides having valuable medicinal properties as a tonic. Robert E. C. Stearns read a suggestive paper on the growth of certain California forest trees, and meterological data suggested thereby. The death of Henry Chapman, the taxidermist and curator of mammals and birds of the Academy, was announced, and resolutions of respect to his memory were adopted.

THE SAN DIEGO SOCIETY OF NATURAL HISTORY held its eighth annual meeting in the new building recently erected by the Society, on Sixth street, November 18, 1881, the President, Dr. G. W. Barnes, in the chair. There was a good attendance of members, and of visitors on invitation.

Mr. C. J. Fox exhibited an Indian relic, probably a medicine tube, from Temecula cañon. Mr. O. N. Sanford exhibited an enormous beetle from Africa.

The president gave the substance of a communication from Mr. Henry Hemphill, of Oakland (now of San Diego), addressed to Mr. Tryon, and by him submitted to the Philadelphia Academy of Sciences, describing a species of Acmæa collected by him, which was also presented to the Academy of Sciences. Mr. Hemphill had discovered that the *Acmæa pelta* and *Nacella instabilis* were identical, apparent differences depending on stages of growth and effect of station. It is regarded as an interesting addition to our limpets. Annual reports of the librarian, treasurer and president were made.

STATE NATURAL HISTORY SOCIETY OF ILLINOIS.—The annual meeting was held at Champaign, February 28 to March 2, 1882. About thirty members were present, with an unusually good local attendance. Twenty-two papers were presented, nineteen of which were read. Mr. Wm. McAdams gave an account of the religion of the mound builders, as indicated by idols and other relics of a religious character, and also described the "Great Cahokia Mound," opposite St. Louis, and other mounds of that vicinity, giving the results of a recent survey of the group. Mr. F. S. Earle described the mounds of a part of south-eastern Missouri, explored by him last autumn for the Smithsonian Institution. Mr. F. M. Webster gave an account of the appearance and movements of the Army Worm in north-eastern Illinois, in 1881. Mr. S. A. Forbes described the lateral organs of blind fishes and reported the results of a series of observations and experiments on the first food of the white fish. Mr. J. A. Armstrong described the life history of a jelly fish; and Mr. C. W. Butler contributed a number

of notes on the habits of animals and described the effect of the poison of snakes upon red blood-corpuscles, as determined by his recent experiments. Mr. A. B. Seymour read a paper on methods of field work on parasitic fungi. Professor T. J. Burrill reported the normal occurrence of bacteria in the juices of plants, which act as ferment poisons on man, and also explained some recent improvements made in microscope objectives, and Mr. C. W. Rolfe gave the results of some experiments made by him on the directions taken by the roots of germinating seeds, and some observations on the number of rings exhibited by cross sections of the wood of trees of known age. The latter gentleman likewise read a paper on the improvement of methods of science teaching in the public schools. Dr. Edward Evans described the rock system of Northern Illinois, Wisconsin and Iowa, as indicated by records of deep borings, and gave a theory of the artesian water supply of this region; and Professor D. C. Taft delivered a lecture on the fossil tracks of the Connecticut valley. Mr. James Forsythe read an abstract of the proceedings of the last meeting of the Industrial University Natural History Society, and Professor N. C. Ricker described and illustrated the "blue process" of copying manuscript, drawings, plates, etc., by photography. The evening of Wednesday was devoted to a reception given to the society by the faculty and students of the university, an interesting feature of which was a fine microscope display, given jointly by the society and the university. The officers selected for the ensuing year were: President, Dr. J. W. Taylor, Kankakee; Secretary, S. A. Forbes, Normal; Treasurer, Tyler McWhorter, Aledo; Vice-Presidents, Professor T. J. Burrill, Champaign, and Hon. William McAdams, Otterville, and additional members of the Executive Committee, Dr. Edwin Evans, Streator, and Dr. E. R. Boardman, Elmira. The reports of the Secretary and Treasurer showed that the society was in a flourishing condition as to funds and membership.

Boston Society of Natural History, February 15.—Mr. S. Carr remarked on the Indians as mound-builders, and Mr. W. M. Davis concluded his paper on the origin of lake-basins—the "obstruction type."

March 1.—Dr. W. S. Bigelow spoke of some points in connection with the theory of spontaneous generation and the life-history of the lowest organism.

New York Academy of Sciences, March 6.—Mr. W. E. Hidden remarked on a phenomenal "pocket" of quartz crystals containing inclusions of water and carbon dioxide. Mr. N. H. Darton read some notes on the Weehawken tunnel.

Appalachian Mountain Club, Boston, March 9.—Professor G. L. Vose made a communication on the relation of mountains

to the construction of railways. The president exhibited a new map of a portion of Japan, on porcelain.

American Geographical Society, February 24.—Mr. George Kennan lectured on Siberia.

Middlesex Institute, January 11, 1882.—Mr. Herbert Gleason read a paper on Structural geology as illustrated by the formation of the American continent. E. H. Capen, president of Tufts College, Professor John P. Marshall and Dr. A. S. Packard, Jr., were elected honorary members.

February 8.—President Dame read a paper on Schools of forestry. A paper from Warren H. Manning, of Reading, on the cultivation of trees, was read by the secretary, and followed by a general discussion. The executive committee announced a course of instructive lectures in the different departments of botany for the remainder of the winter season.

February 15.—Professor Edward S. Morse delivered a lecture on the Ancient glaciers of North America.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

American Journal of Science, March.—Gold-bearing rocks of the province of Minas Geraes, Brazil, by O. A. Derby. The flood of the Connecticut River valley from the melting of the Quaternary glacier, by J. D. Dana. Geographical distribution of certain fresh-water mollusks of North America, and the probable causes of their variation, by A. G. Wetherby. Description of a new genus of the order Eurypterida from the Utica slate, by C. D. Walcott. Notice of the remarkable marine fauna occupying the outer banks off the southern coast of New England, No. 4, by A. E. Verrill. Origin of jointed structure in undisturbed clay and marl deposits, by J. LeConte.

Geological Magazine, February.—*Cyrena fluminalis* at Summertown, near Oxford, by J. Prestwich. On Spermophilus beneath the glacial till in Norfolk, by E. T. Newton. Supplement to a chapter in the history of meteorites, by W. Flight. Traces of a great post-glacial flood, by H. H. Howorth (concluded).